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# ERRATA

page 24 line 30 for 'Bauer' read 'Baur'
54 lines 2 and 8 for '*P. graminis secalis*' read '*P. rubigo-vera secalis*'
line 11 for '*P. triticina*' read '*P. rubigo-vera* [*triticina* = *P. triticina*]
82 28 for '*longuis*' read '*longius*'
84 lines 20 and 22 for 'to' read 'by'
85 line 11 after 'Holmes)' insert 'strains'
85 12 for 'name and name' read 'names and names'
114 13 for '*popiliae*' read '*popilliae*'
14 for '*Popilia*' read '*Popillia*'
272 45 'Lichtenfelde' read 'Lichterfelde'
284 27 for 'identical with' read 'due to frost injury of trees affected by'
for 'due to some similar' read 'or some'
291 lines 18 and 19 for '36 and 12' read '12 and 36'
322 line 5 for 'xx' read 'xix'
328 23 for '*Pine*' read '*Pinus*'
390 26 for 'Gries' read 'Greis'
433 31 for 'and' read 'which'
449 41 for '*spinacea*' read '*spinaciae*'
466 13 for 'Great Britain' read 'British Isles'
491 17 for 'Chariton (E. G.)' read 'Chariton (J. G.)'
509 4 for 'Bremer (A.)' read 'Bremer (H.)'
516 45 for '*cucumis*' read '*cucumeris*'
518 23 for '*levis*' read '*avenae*'
547 20 for '*ciborius*' read '*cibarius*'
596 43 for '*menthae*' read '*mentha*'
597 19 for '*kamerunsis*' read '*kamerunensis*'

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VOL. XX JANUARY 1941

JUNELL (S.). **Granens rostsvampar.** [Spruce rusts.]—*Skogen*, xxvii, 10, pp. 179–181, 4 figs., 1940.

Outlines are given of the life-histories of the rusts attacking spruce in Sweden, viz., *Chrysomyxa woronini*, *C. ledi* [*R.A.M.*, xvi, p. 191] (the alternate host of both of which is *Ledum*), the monoecious *C. abietis* [ibid., xviii, p. 348], *C. pyrolae* [ibid., xviii, p. 643] (*Pyrola*), and *Pucciniastrum padi* [ibid., vi, p. 701] (bird cherry [*Prunus padus*]).

EADES (H. W.). **Sap-stain, mould, and decay in relation to export shipments of British Columbia softwoods.**—*Circ. For. Serv.* 57, 12 pp., 1940. [Mimeographed.]

Particulars are given of an inquiry conducted by the Forest Products Laboratories, Dominion (of Canada) Forest Service, into the various factors involved in the production of sap stain, mould, and decay in British Columbia softwood timber [*R.A.M.*, xi, p. 614] destined for export to overseas markets, where complaints have been made of its arrival in a 'de-graded' and blemished condition, while in certain cases actual decay is alleged to have been present.

The investigations were carried out on a number of test shipments to Australian and English ports and on one to Montreal. Western white pine [*Pinus monticola*] was found to be the most susceptible of the export woods to sap stain and mould, followed by Sitka spruce [*Picea sitchensis*], western hemlock [*Tsuga heterophylla*], and Douglas fir [*Pseudotsuga taxifolia*], western red cedar [*Thuja plicata*] being highly resistant to this type of injury. *Picea sitchensis* and, to a lesser extent, *Pseudotsuga taxifolia* are also subject to infection by a mould producing 'pink dote', i.e., superficial terra cotta or brick-red spots both on the heart- and sapwood [cf. ibid., xix, p. 629]. Temperature conditions in British Columbia, except during the extreme cold of winter, are generally favourable to initial infection by sap stain and moulds, the further development of which in transit is promoted by the heat and lack of ventilation prevailing in ships' holds during voyages through subtropical and tropical waters.

The robust, leathery, white or yellow mycelial mats sometimes formed by *Fomes pinicola* on timber, especially of *Tsuga heterophylla* and *P. taxifolia*, in storage or transit are readily distinguishable from the green or mottled green discoloration due to the moulds. According to Cartwright, three-quarters of the incidence of definite rot, involving

internal disintegration of the wood, in Douglas fir imported into England is attributable to *Trametes serialis* [ibid., xviii, p. 361]. All forms of decay are liable to spread in coniferous timber left in large piles in the open for protracted periods.

The best means of prevention of the defects under discussion is the reduction of the moisture content of the wood to 20 to 25 per cent. by air-seasoning or kiln-drying before shipment, during which and after arrival at its destination the timber must of course also be maintained in a dry state. Two groups of chemicals, viz., organic mercury compounds and various chlorinated phenols, afford valuable protection against sap stain, but are less effective in mould control and entirely useless in the control of any kind of infection already established in the wood.

LONG (W. H.) & GOODDING (L. N.). **Notes on Gymnosporangium cupressi.**—*Mycologia*, xxxii, 4, pp. 489–492, 1 fig., 1940.

In this paper the authors describe the pycnidial and aecidial stages of a fungus on *Amelanchier mormonica* (?), which circumstantial evidence indicates as belonging to the life-cycle of *Gymnosporangium cupressi*. An emended description of the teleutospore stage found on *Cupressus arizonica* and its var. *bonita* is given.

RAY (W. W.). **Notes on Gymnosporangium in Oklahoma.**—*Mycologia*, xxxii, 4, pp. 572–574, 1940.

An annotated list is given of eight species and varieties of *Gymnosporangium* found on *Juniperus* in Oklahoma in the spring of 1939. *J. mexicana* in the Arbuckle Mountains was attacked by *G. exiguum*, nearly every tree of several hundreds examined being infected, though no ill effects were apparent. This is the first report of the fungus in Oklahoma. *J. mexicana* remains immune from *G. juniperi-virginianae* even if many infected *J. virginiana* trees are present in the vicinity. Nurserymen are, therefore, recommending the use of *J. mexicana* in the place of *J. virginiana*.

WILSON (J. D.). **Certain injurious effects of spraying vegetables with the fixed coppers.**—*Bi-m. Bull. Ohio agric. Exp. Sta.*, xxv, 203, pp. 36–43, 1940.

Some of the fixed copper preparations now widely used in Ohio at a strength of 1 part of metallic copper in 50 gals. as substitutes for Bordeaux mixture in the control of vegetable diseases [*R.A.M.*, xix, p. 507] have been found to cause various types of injury. For instance, the yield of carrots treated against *Macrosporium* [*carotae*] and *Cercospora* [*carotae*] was reduced by cuprocide 54-Y from 18 to 16 and from 22·7 to 9·5 tons per acre in two tests on muck and sandy loam soils, respectively, in which no infection developed. Coposil caused considerable foliar damage and reduced the yield in the sandy loam plots to 11·6 tons per acre. On the muck soil Grasselli copper A caused no decline in output and copper hydro 40 only a slight drop, whereas on the loam the yields from the plots treated with these preparations were only 16·5 and 16·3 tons per acre, respectively, compared with 22·7 in the controls, the corresponding figures for Bordeaux mixture, tribasic

copper, and 'copper oxychloride sulphate' being 19·5, 15·8, and 15·0 tons per acre, respectively. In another trial on muck soil in which the leaf spots were severe, the yield was 23·8 tons per acre for the controls and 32·6, 32·3, 31·4, 30·9, 30·7, 29·4, and 27·4 tons per acre for the plots treated with Bordeaux mixture, tribasic copper, basic copper arsenate, Grasselli copper A, cuprocide 54-Y, cupro-K, and brown cupric oxide, respectively.

Tomatoes afford a striking example of the consistent failure of spraying to increase yields unless leaf spot (*Septoria* [*lycopersici*]) occurs in a sufficiently acute form to cause at least 20 per cent. defoliation in the absence of control measures. Bordeaux mixture and (to a lesser extent) some of the fixed coppers have also been observed to delay the ripening of tomatoes and increase the incidence of blossom-end rot.

In 1939 all the fixed coppers reduced the yields of Lima beans [*Phaseolus lunatus*] in which bacterial leaf spot [*Bacterium phaseoli*] did not develop, cuprocide 54-Y, tribasic copper, and brown cupric oxide causing the heaviest losses (the yields being only 75, 74, and 74 lb. per plot as against 86 lb. for the controls) in one series of tests, and copper oxychloride sulphate and cuprocide 54-Y in the other (46 and 36 lb. compared with 80 lb.).

The maturity of muskmelons sprayed against bacterial wilt [*Erwinia tracheiphila*] and miscellaneous leaf spots tends to be retarded by the fixed copper preparations, but the increased yield of ripened fruit may be considered to outweigh the drawbacks.

NAGEL (C. M.) & LEONARD (O. A.). **The effect of Cercospora beticola on the chemical composition and carbon assimilation of Beta vulgaris.**—*Phytopathology*, xxx, 8, pp. 659–666, 1940.

A comparative study was carried out at the Iowa State College on the chemical composition of three groups of sugar beet plants, (1) infected by *Cercospora beticola* [*R.A.M.*, xix, p. 687], (2) pruned in such a way as to simulate defoliation by the fungus, and (3) healthy. The disease reduced the sucrose percentages in the roots from 15·27 to 12·08, in the crowns from 13·63 to 11·18, in the leaf blades from 1·99 to 1·18, and in the petioles from 9·84 to 3·48. The amount of total nitrogen in the diseased roots (0·161 per cent. of the fresh weight) and crowns (0·237 per cent.) of greenhouse plants exceeded that in the pruned (0·109 and 0·183 per cent.) and healthy (0·096 and 0·185 per cent., respectively), the corresponding figures for field grown plants being 0·229 and 0·314, 0·174 and 0·242, and 0·183 and 0·285. The roots and crowns of infected plants, grown in the greenhouse or field, were higher in soluble nitrogen than the corresponding pruned and healthy tissues. The total nitrogen values were found to decline in the leaf blades and petioles as the disease progressed. The capacity of the foliage for the assimilation of carbon dioxide from the air also diminished as the incidence of the disease advanced, from 6·30 mg. per 100 sq. cm. per hour to 0·49 in extensively necrosed foliage.

BROOKS (A. N.). **Control of sclerotiniose of Celery on Florida muck.**—Abs. in *Phytopathology*, xxx, 8, p. 703, 1940.

The results of controlled temperature experiments showed that the

minimum, optimum, and maximum temperatures for mycelial growth in *Sclerotinia sclerotiorum*, the agent of severe damage to celery [*R.A.M.*, xviii, p. 789] on muck soils near Sarasota, Florida, under humid conditions, are below 45°, 75°, and 83° to 89° F., respectively. Below 70° the sclerotia produced apothecia within 28 to 34 days, but none developed above this point. Sclerotia buried deeper than 3 in. in the soil formed only stipes incapable of reaching the surface and giving rise to apothecia. Deep ploughing gave poor control, since not all the sclerotia were buried to the requisite depth, but flooding the muck for six to eight weeks in the summer destroyed 90 per cent. of these organs, while post-harvest or pre-planting applications of calcium cyanamide were equally effective.

NEUWEILER (E.). **Pflanzenschutz.** [Plant protection.]—*ex* **Bericht über die Tätigkeit der Eidg. landwirtschaftlichen Versuchsanstalt Zürich-Oerlikon für die Jahre 1934–1938.** [Report on the work of the Federal Agricultural Experiment Station Zürich-Oerlikon for the years 1934 to 1938.]—*Annu. agric. Suisse*, xlv, 3, pp. 345–355, 1940.

In the first four of the five years under review [cf. *R.A.M.*, xv, p. 1], Abramoff's method of disinfecting wheat seed-grain against bunt [*Tilletia caries* and *T. foetens*] by mixing it with sawdust impregnated in 0·2 per cent. formalin [ibid., xi, p. 35] was tested with very satisfactory results as regards elimination of the pathogens and increased production, but germinability was slightly impaired. Of the other preparations tested for the same purpose, U. 564 (I.G. Farbenindustrie, Leverkusen) again [ibid., xv, p. 1] gave good control, immersion and sprinkling being superior to the short disinfection process, which also proved inadequate in the case of germisan. G4207 II (Sacharinfabrik, Magdeburg S.O.), applied in liquid and dry forms, exerted a strong fungicidal action in 1937–8, but was slightly detrimental to germination. Abavit also combated the disease effectively. Of the dusts used in the trials, sagran (R. Maag, Dielsdorf), F.D. (Flora, Dübendorf), abavit-universal, abavit-neu, and Präparat 413a (L. Meyer, Mainz) [ibid., xv, p. 285] were approved for the end in view. Formalin, uspulun-universal, and ceretan [ceresan], included as controls, maintained their reputation.

Of recent years loose smut of wheat [*Ustilago tritici*] has become more prevalent, especially in the winter variety Mont Calme and the summer Huron. Control may be effected by ten minutes' immersion of the seed-grain in water heated to 52° C., preceded by four hours' soaking at 25° to 30°; the winter wheat responded somewhat better than the summer to this treatment. The addition of a 4 per cent. alcohol solution to the hot water, recommended by Gassner [ibid., xii, p. 500], in no way contributed to the success of the method.

Ceresan-liquid and Schering's liquid steep 3030 and dust 910 gave perfect control of *U. avenae* on oats in one year's tests.

The following average increases of yields over the untreated controls were obtained from 1934 to 1938 in potato spraying experiments with various preparations [against *Phytophthora infestans*: ibid., xv, p. 1]: cusisa 19·7 per cent., kupferkalk Siegfried 16·2, Bordeaux Xex [ibid., xviii, p. 87] 12·5, Ob 21 neu 10·2, kukaka 9·1, cupro Maag 7·4, Sch

1153 7, fungolit 4·3, neotox 4·2, and Ob 21 0·8. An attempt was made to forestall the development of the brown rot phase of late blight in the tubers by cutting off the sprayed haulms 10 to 14 days before lifting, or burning them with sulphuric acid [ibid., xvii, p. 131], but both in 1937 and 1938 these practices led to diminished assimilation and a consequent reduction of yield amounting to 3·5 and 4·2 per cent. for cutting and burning, respectively.

The use of preservatives, including karsan [ibid., xv, p. 224], for the control of storage rots of potato may be expected to give beneficial results only under unfavourable harvesting and keeping conditions. Many of the preparations sold for this purpose contain formaldehyde, the use of which for the preservation of table potatoes is prohibited by the Swiss food laws.

The percentages of black scurf [*Corticium solani*] and scab [*Actinomyces scabies*] counted in the seed potato examinations of 1934, 1936, 1938, and 1923 to 1938 were 10·6, 2·7, 6·7, and 8·6, and 7·8, 8, 8·4, and 5, respectively.

Since the potato wart [*Synchytrium endobioticum*] epidemic of 1931 [ibid., xi, pp. 468, 495] there has been only one severe outbreak of the disease, in Ticino in 1937, which was effectively combated by the cultivation of immune varieties. Bacterial ring rot (*Bacillus* [*Bacterium*] *sepedonicum*) was recorded for each of the years 1934, 1936, 1937, and 1938.

EASTHAM (J. W.). **Report of Provincial Plant Pathologist.**—*Rep. B.C. Dep. Agric., 1938*, pp. L42–L48, 1939; ibid., *1939*, pp. B57–B60, 1940.

The only new disease reported for British Columbia during 1938 [cf. *R.A.M.*, xvii, p. 797] was bean [*Phaseolus vulgaris*] rust (*Uromyces appendiculatus*), which occurred in the plantings of two Japanese growers at Pitt Meadows. It is widely distributed in Eastern Canada in a mild form.

Downy mildew (*Peronospora effusa*), occasionally recorded in the past on spinach and prevalent on *Chenopodium album*, for the first time caused heavy damage on the canning crop in the Vancouver District.

Cherry mosaic [ibid., xvi, p. 192] is practically restricted to the City of Nelson, Kootenays, where upwards of 100 trees are thought to be involved. Pending the development of some easily applicable and reliable objective test, the initiation of a compulsory eradication campaign presents great difficulties, since some of the diseased trees with marked foliar symptoms continue to yield heavy crops of fruit, and their owners are naturally reluctant to have them destroyed. D. G. Milbrath, in a tour of inspection, observed suspicious symptoms on the widely distributed wild *Prunus emarginata*, which is known to be a host of mosaic and may well develop into a reservoir of infection for cultivated cherries. A mild type of mottling found on winter-injured cherry trees in 1937 had disappeared in 1938, confirming the supposition of a connexion between damage from cold and a certain form of chlorosis. An abnormality of cherry trees associated with foliar elongation, deep and irregular indentation, and asymmetry [ibid., xvi, p. 707] was pronounced by D. G. Milbrath to be in all probability identical with

crinkle, a genetic disorder occurring in California, and confirmatory evidence was afforded by the normal development in the Okanagan of grafts from a healthy tree worked on an abnormal one. On the other hand, samples of crinkle gave positive reactions for the presence of a virus, possibly of independent occurrence, in laboratory tests. A trouble resulting in the failure of apparently healthy Lamberts to produce fully ripe fruit was declared by the above-mentioned authority to be definitely distinct from buckskin [ibid., xiv, p. 111].

'Flat limb' is the name proposed for a peculiar malformation, apparently of virus origin, of Gravenstein apple trunks and branches, which yielded neither bacteria nor fungi.

Pear scab [*Venturia pirina*] in coastal situations proved amenable to treatment with bouisol or lime-sulphur in a series of experiments from 1936 to 1938, the average percentages of marketable fruit obtained being 84·6 and 84·9, respectively, compared with 80·1 and 58·9 for Bordeaux mixture and the controls, respectively. Three applications, at the pink and calyx stages and three weeks after the latter, suffice in an average season.

Ridit, a winter wheat resistant to bunt [*Tilletia caries* and *T. foetens*], has been licensed by the Dominion Government after seven years' test. In 1937–8 the percentage of infection in this variety at Armstrong was 0·1 and its yield 40 bush. per acre compared with 41·5 per cent. bunt and 19·1 bush. for Jones Fife; others giving outstanding results included Triplet × White Odessa (0·1 per cent. bunt and 43·9 bush. per acre), White Odessa × Hard Federation (0·0 and 32·6, respectively), Hymar (0·0 and 34), and Hussar (0·4 and 43·9).

Defoliation of English holly in storage was experimentally shown to be controllable by the maintenance of a low temperature (32° to 40° F.) and the omission of waxed paper as a lining for the packing cartons where any possibility exists of a rise to upwards of 50°.

The following new diseases were recorded in 1939: dark berry of *Cotoneaster horizontalis* (*Phytophthora cactorum*), responsible for a pale grey to black discoloration impairing the ornamental value of the shrub; *Cytospora* [*Valsa*] *ambiens* [ibid., xiii, p. 244], isolated from the bark of *Cotoneaster simonsii* twigs and branches apparently killed by the fungus; filbert [*Corylus avellana*] canker (*Phomopsis revellens* von Höhn.), in which the share of the fungus was difficult to determine owing to previous damage by neglect and fire; leaf spot of *Rhododendron* (*Diplodina eurhododendri*); and halo blight of beans (*Phytomonas* [*Bacterium*] *medicaginis* var. *phaseolicola*), nearly all the infected crops of which were raised from seed purchased from registered seed growers in Ontario.

Stony pit of Bosc pears, formerly believed to be a form of drought spot, failed to yield to soil improvement treatments with boron in 1938 and is now attributed to the virus causing a similar disease in the United States [ibid., xviii, p. 463].

Five of the ten spring wheat varieties tested for their reaction to black chaff (*Bact. translucens* var. *undulosum*) [cf. ibid., xviii, p. 665] remained free from infection, viz., Red Bobs, Marquis, Thatcher, Canus, and C–26–44·7, Garnet and Reward were slightly attacked, Regent moderately, and Apex and Renown severely.

In trials on the reaction of various leguminous fodders to wilt (*Sclerotinia trifoliorum*), subterranean clover [*Trifolium subterraneum*] Ott. 1559 and crown vetch [*Coronilla varia*] were immune, while early red clover [*T. pratense*], sainfoin, and bird's foot and yellow trefoils [*Lotus corniculatus* and *T. procumbens*] developed 40, 60, 15, and 35 per cent. infection, respectively.

THOMPSON (A.). **Notes on plant diseases in 1939.**—*Malay. agric. J.*, xxviii, 9, pp. 400–407, 4 pl., 1940.

In these notes on plant diseases in Malaya in 1939 [cf. *R.A.M.*, xviii, p. 503] the author states that fructifications of *Fomes noxius* and *Ganoderma lucidum* have been observed to develop only on felled oil palms affected with stem rot prior to felling. The fungi most commonly found on felled stems are *Poria ravenalae* [ibid., xvi, p. 656], *Polystictus sanguineus*, and *G. applanatum* var. *tornatum* [ibid., xi, p. 105; xii, p. 116; xv, p. 16]. Evidence was obtained that it is safe to bury stems infected with *F. noxius* provided the oil palm area is not to be replanted with rubber, tea, or other dicotyledonous crops. In some localities, bronzing and yellowing of the older leaves, frequently accompanied by orange spotting of the pinnae of the tips of the younger leaves, was prevalent. Crown disease was common in replanted and newly opened-up areas.

No differences in hydrogen-ion concentration of the stem juices ($P_H$ 5·4) and leaf juices (4·2) were observed between healthy and wilted Singapore Canning pineapples. The leaf juices of this variety were considerably more acid than those of Smooth Cayenne in Hawaii.

Die-back of tea on the higher land of an estate in Selangor appeared to have been induced by drought. An increase in the number of seed-bearers killed by *Poria hypolateritia* was observed at the Tanah Rata station, Cameron Highlands, where, however, *Ustulina zonata* [ibid., xviii, p. 504] remains the usual cause of the death of tea bushes and seed-bearers. Highland tea was attacked by *Sphaerostilbe repens* [ibid., xix, p. 369].

*Marasmius semiustus* [*M. stenophyllus*] was recorded for the first time as responsible for the death of dry land (hill) rice, a considerable number of the plants being killed. The fungus set up a decay of the outer leaf sheaths which spread inwards at the base. A species of *Aframomum* growing as a weed in the vicinity was also killed. Infection was favoured by poor soil conditions. Glume spot of rice was caused by *Pyrenochaeta oryzae* [ibid., xiii, p. 652].

Rotting of the young green fruits of *Nephelium lappaceum* and splitting of maturing fruits due to *Oidium* sp. [ibid., xviii, p. 504] were again observed at Johore on the trees affected in 1938, the condition also occurring for the first time in Selangor. An undescribed *Phomopsis* was associated with a wilt of seedlings and a die-back of the scions of *N. lappaceum* buddings. Isolations from tissues of branches of the same host affected by blistering and hypertrophy yielded *Nectria haematococca* [ibid., xviii, p. 795] and other organisms, inoculations with all of which gave negative results.

During wet weather, severe fruit rot of papaw was caused by *Phytophthora palmivora* (rubber strain), which also attacked the trees at soil-

level, with resultant root and collar rot [ibid., xviii, p. 655]. *P. parasitica* caused foot rot of the same host in Johore.

The fungus resembling *U. zonata* reported as associated with *F. noxius* in a root and collar decay of avocado pear [ibid., xviii, p. 504] was identified by E. W. Mason as *Nummularia anthracodes* (Mont.) Cooke var. *gliricidiae* Rehm. Cultures from the fructifications yielded a species of *Xylocladium*, possibly parasitic on the *Nummularia*, or representing its conidial stage.

*Colocasia esculenta* plants in Perak and Selangor were affected by leaf blight due to *P. colocasiae* [ibid., xviii, p. 505], the fungus occasionally causing corm decay. The disease is not likely to be of importance except in wet weather. The same organism also caused wilt of *Piper betle* in Perak and Pahang.

*Cinchona ledgeriana* was affected by a die-back favoured by failure of the roots to penetrate a stiff subsoil; *P. cinnamomi*, not previously recorded on *Cinchona*, was isolated from the decaying root tissues and identified by S. F. Ashby. Inoculations showed the fungus to be a weak parasite. It was also isolated from wilted seedlings of *C. succirubra*, *C. ledgeriana*, and hybrid seedlings of these species. The plants showed bark rot and canker at the collar, and the stems were split to a height of 3 to 9 in.

The only fungus likely to cause disease that has been found in compost, increasingly used as a manure locally, is *Sclerotium rolfsii*. Plants affected by any disease should not be used for composting.

**Plant diseases. Notes contributed by the Biological Branch.**—*Agric. Gaz. N.S.W.*, li, 9, pp. 517–521, 3 figs., 1940.

With either of the two alternative Bordeaux mixture spraying programmes recommended for the control of citrus black spot [*Phoma citricarpa*: *R.A.M.*, xix, pp. 69, 143] in New South Wales, the first application should be effected when most of the blossoms on the northern side of the trees have shed their petals, but before all the petals have fallen from the opposite side. The addition of ½ gal. red spraying oil per 80 gals. spray is recommended for spreading purposes. The increased control of black spot brought about by using either programme in conjunction with two applications of white oil [loc. cit.] has amounted in some instances to as much as 16 per cent. The first oil application is made about mid-December, and the second about mid-February, the concentration in each case being 1 in 40.

Strawberry leaf scorch (*Diplocarpon earliana*) [ibid., xix, p. 692] is stated to be very prevalent locally, and recommendations for its control are suggested.

Pontis (R. E.). **Observaciones fitopatológicas.** [Phytopathological observations.]—*Bol. agríc., Mendoza*, viii, 5–6, pp. 162–168, 4 figs., 1 diag., 1940.

An account is given of the writer's recent observations on spotted wilt of tomatoes, which is stated to constitute an economic problem in the province of Mendoza, Argentine Republic, where severe damage was also caused during the period of the investigations [presumably 1939 to 1940] by downy mildew of the vine (*Peronospora*) [*Plasmopara*

*viticola*], celery blights (*Septoria apii* and *S. apii-graveolentis*), and shot hole of stone fruits (*Coryneum* [*Clasterosporium*] *carpophilum*) [*R.A.M.*, xix, p. 544], especially Grand Monarch peaches.

Takimoto (S.). **Bacterial plant diseases in Japan. (8). Additional new host plants for Bacterium solanacearum.**—*Bult. sci. Fak. terk. Kjuŝu Univ.*, ix, 1, pp. 1–6, 3 figs., 1940. [Japanese, with English summary.]

From the discoloured vascular bundles of dahlias and beans [*Phaseolus vulgaris*] suffering from wilt disease during hot summer weather *Bacterium solanacearum* was isolated and inoculated with positive results into these hosts, tobacco, and tomato. The strains of the organism from the two latter plants were likewise pathogenic to dahlias and beans. No physiological differences were found to exist between the bacteria from the various sources under observation. The dahlia wilt is believed to be identical with that previously attributed by S. Hori to *Bacillus dahliae*.

Matsumoto (T.). **Phage-produced resistant strains of Bacillus aroideae. II. The behaviour of the organisms in phage-inoculated sand cultures.**—*Trans. nat. Hist. Soc. Formosa*, xxx, 200–201, pp. 89–98, 1940.

The bacteriophage specific for *Bacillus* [*Erwinia*] *aroideae* [from radishes: *R.A.M.*, xix, p. 266] was found to accumulate more abundantly and maintain its activity longer in sand cultures than in phaged potato dextrose solutions. Most of the organisms isolated from the phaged sand cultures were found to be still susceptible to the bacteriophage, whereas those from liquid media were rapidly converted into resistant forms. As in the case of the liquid cultures, the multiplication of the bacteria in the sandy substrata was considerably reduced by the admixture of the bacteriophage.

Dillon Weston (W. A. R.). **Seed treatment.**—*J. Minist. Agric.*, xlvii, 2, pp. 103–106, 1940.

Brief, practical notes are given on cereal seed disinfection by means of copper sulphate, formalin, and organic mercury dusts [*R.A.M.*, xix, p. 521].

Arzuaga (J. G.). **Perspectivas de producción de nuevas variedades de Trigo en el Instituto Fitotécnico de Santa Catalina.** [Prospects for the production of new Wheat varieties in the Phytotechnical Institute of Santa Catalina.]—*An. Inst. fitotéc. Santa Catalina*, i, pp. 9–15, 1939. [Issued 1940. Abs. in *Plant Breed. Abstr.*, x, 4, p. 279, 1940.]

Two of the hybrids derived from a cross between Chinese 166 (resistant to *Puccinia glumarum*) [*R.A.M.*, xiii, p. 620] and Lin Calel have given promising results in tests at Santa Catalina [Argentina], combining immunity from the rust with superiority to the standard La Previsión 25 in yield and to 38 M.A. in baking quality. A cross between Ardito and Lin Calel also yielded a hybrid uniting fair resistance to *P. glumarum* and *P. triticina* with satisfactory production and baking quality.

**Informe anual correspondiente al año agricolo 1939–40.** [Annual report for the agricultural year 1939–40.]—*Bol. Chacra Exp. 'La Previsión'* 3, pp. 3–33, 1940. [Abs. in *Plant Breed. Abstr.*, x, 4, p. 273, 1940.]

Resistance to bunt (*Tilletia* sp.) is stated to have been maintained by a selection of the Kanhard wheat variety made at the Chacra Experiment Station, Brazil, a list being given of other highly or moderately resistant varieties. Resistance to *Ustilago hordei* has been shown by the forage barley R.M. 85 and the malting selection 112/30 Bve.

CHESTER (K. S.). **A machine for controlling loose smut in Wheat and Barley.**—*Circ. Okla. agric. Exp. Sta.* 86, 8 pp., 2 figs., 1 diag., 1940.

To meet the need for a convenient, economical, and effective co-operative seed-grain treatment for the control of loose smuts of wheat [*Ustilago tritici*] and barley [*U. nuda*], a portable machine has been constructed at the Oklahoma Agricultural Experiment Station for the application of the hot water method of disinfection. Usually only sufficient seed-grain is treated to plant a separate plot, the wheat harvested from which is used the following season to plant the main acreage. A full-sized machine of the type described in the present paper has a treating capacity of 500 bush. per day, corresponding to a smut-free acreage the following year of 500 to 1,000 acres. The model in actual use has been built to $\frac{2}{5}$ scale, the maximum cost of construction being estimated at $200.

The apparatus consists of grain baskets attached to 4 in. rubber conveyor belts arranged to rotate at a speed requiring exactly 10 minutes for the baskets to move from one end of the hot water tank to the other. A double-walled partition, packed with mineral wool, separates the larger tank, in which the temperature (for wheat) is maintained at exactly 129° F., from the smaller pre-heating tank, containing water heated to about 120° by means of free steam bubbling through $\frac{1}{16}$ in. jets in three valve-controlled pipes. The seed baskets are constructed of galvanized screen wire, reinforced by rigid wire rods. Each bath contains a floating thermometer for temperature regulation. Barley requires 13 minutes' immersion at 126°, necessitating the substitution of a slightly larger gear wheel on the drive shaft. Although the heat treatment is a preventive of wheat bunt [*Tilletia caries* and *T. foetens*] as well as of *U. tritici*, the subsequent dusting of the seed-grain with an organic mercury dust, such as new improved ceresan, is recommended to guard against soil-borne infection.

GARRETT (S. D.). **Temporary leys and the take-all and whiteheads disease of Wheat and Barley.**—*J. Minist. Agric.*, xlvii, 2, pp. 134–135, 1940.

As a result of tests carried out at Rothamsted with 17 common pasture grasses, *Phleum pratense* and *Arrhenatherum avenaceum* are confidently recommended as highly resistant to *Ophiobolus graminis* [*R.A.M.*, xix, p. 525]; a temporary ley of either in combination with clover will, therefore, no longer act as a carrier of infection from barley to the next wheat crop.

RUSSELL (R. C.) & SALLANS (B. J.). **The effect of phosphatic fertilizers on common root rot.**—*Sci. Agric.*, xxi, 1, pp. 44–51, 1940.

In field plot experiments conducted in several localities in Canada during 1937, 1938, and 1939, wheat receiving applications of phosphatic fertilizers generally exhibited a somewhat higher rate of infection by common root rot (*Helminthosporium sativum* and *Fusarium* spp.) [*R.A.M.*, xix, p. 650] than did unfertilized wheat. For instance, applications of triple superphosphate (33 lb. per acre) and ammonium phosphate (30 lb.) to plots in four localities in 1937 increased the disease ratings from 11·1, 16·5, 28·8, and 23·1 in the controls to 12·8, 18·0, 30·7, and 25·4, and 12·2, 16·4, 29·8, and 24·9, respectively. In 1939 disease ratings for untreated plots and plots treated with triple superphosphate, ammonium phosphate, and ammoniated superphosphate (33 lb.) in four localities were 11·5, 5·8, 25·2, and 26·7; 17·5, 9·3, 27·0, and 27·9; 18·9, 11·5, 28·8, and 26·4; and 15·8, 9·5, 27·4, and 27·5, respectively. Nevertheless, the fertilized wheat frequently yielded more grain than did the unfertilized. It is concluded that the increase in yield, due to the phosphates, more than balances the losses due to the increase in disease. Under other conditions, however, it might be possible for the influence of the disease to outweigh the effect of the phosphatic fertilizers.

CARROLL (P. T.). **The effect of certain powder disinfectants on the control of leaf spot in Oats.**—Reprinted from *J. Dep. Agric. Eire*, xxxvii, 1, 16 pp., 1940.

In small-scale quantitative experiments carried out in Éire in 1932, the average yield of dressed grain per healthy oat plant and per plant showing primary infection by *Helminthosporium avenae* [*R.A.M.*, xvii, p. 809] was, respectively, 3·39 and 1·42 gm., the corresponding figures for 1933 being 4·24 and 2·92 gm. In counts made in 1933, the percentage of infected plants shown by the Glasnevin Sonas, Sonas Marvellous, Potato, Glasnevin Ardri, Glasnevin Success, and Victory II varieties was, respectively, 0·5, 1, 2·5, 7·9, 9, and 12·5 per cent., the corresponding figures in 1934 being a trace, and 1, 3·4, 1·2, 4·25, and 1·5 per cent. In small-scale tests in 1932, seed treatment with ceresan slightly increased establishment and reduced the number of diseased plants in the braird. In 1933, treatment with ceresan, agrosan, and alvit gave mean establishment figures (three varieties together) of 100·39, 101·94, and 99·22 (108 grains sown per plot), as compared with 91·11 for the controls, the corresponding figures for the mean numbers of primarily infected plants per plot being 0·95, 3·22, 0·61, and 11·45. The treatments did not, however, significantly increase the mean yields of grain.

In 1937, treatment of heavily infected Star oats seed with ceresan, agrosan, and abavit gave, respectively, 1075, 1066, and 1057 established plants per plot (279 grains), as compared with 977 in the control; infection averaged under 1 per cent. in the treated plots as against 42 per cent. in the untreated. The average increase in yield of dressed grain due to treatment amounted to approximately 25 per cent., while in 1939, when the experiment was repeated, using a new powder, abavit T.B. 910, in place of abavit, it was about 13 per cent.; in neither year was there any significant difference between the three treatments in

respect of disease control or effect on productivity. The highest primary infection was noted on plants grown from seed obtained from localities with a high rainfall.

These results indicate that the seed treatment of oats against *H. avenae* controls infection satisfactorily, but it does not always give any high increase in the yield of dressed grain when the conditions are such that the plant establishment from untreated seed is not less than approximately 80 per cent. of that from treated seed. Little evidence was obtained that seed dusting stimulated seedling growth. It is, however, prudent even under very favourable conditions to disinfect oat seed before sowing, as disinfection serves as a precaution against high leaf spot infection, particularly when cold, wet weather supervenes, and enables sowing to be carried out earlier.

TURNER (Miss E. M.). **The reaction of Oats to different strains of Ophiobolus graminis.**—*Trans. Brit. mycol. Soc.*, xxiv, 2, p. 267, 1940.

Isolations from oats stubble affected by take-all in Wales yielded a fungus indistinguishable in culture from *Ophiobolus graminis* on wheat, to which oats are usually held to be resistant [*R.A.M.*, xvi, p. 736]. Four varieties of oats, highly resistant to strains of the fungus from wheat, proved very susceptible to the isolates from oats. Ascospores of the oats strain measured 98 to 117 $\mu$ in length compared with 79 to 96 $\mu$ for that from wheat. A new variety of *O. graminis* would thus appear to be concerned in the attack on oats, which are invaded in exactly the same way as wheat, the protoplasmic resistance opposed by the root cells to the common wheat strain of the fungus failing to operate in this case. The effect of extracts from the roots of wheat and oats on the isolates under observation was tested. The strains from oats made uniformly good growth, whereas those from wheat made no growth in untreated or steamed oat extract, or in the sediment left after centrifuging the extract. The wheat isolates, however, grew fairly well in oat extract passed through an L5 filter candle and in the supernatant liquid obtained by centrifuging, besides developing freely in wheat extract. It is concluded that the solid portion of oat extract contains a substance toxic to the fungus isolated from wheat.

WILCOMB (H. H.). **Compatible and non-compatible mixtures of sprays and dusts.**—*Calif. Citrogr.*, xxv, 11, p. 348, 1940.

The author gives a list of compatible and non-compatible plant protectives for use against specified diseases and pests of citrus. The substances include citrus petroleum oils, lime-sulphur solution, lime-sulphur and oil, ammonium polysulphide, nicotine sulphate sprays and dusts, tartar emetic (antimony potassium tartrate), sulphur, zinc, and copper compounds, cryolite (sodium fluoaluminate), DN (dinitro-ortho-cyclohexylphenol), and other less used mixtures.

STREETS (R. B.). **An apparently undescribed storage rot of Grapefruit.**—Abs. in *Phytopathology*, xxx, 9, p. 789, 1940.

The only external symptoms of an apparently undescribed rot observed in April, 1939, in Arizona grapefruit held in cold storage were

a blackening and loosening of the button and a slightly 'brassy' colour of the peel, but longitudinal sectioning in the early stages revealed a browning of the vascular bundles, which developed, a week to a fortnight after the removal of the fruit from storage, into a dark brown rot, involving several of the segments, while in an advanced stage of infection the peel and ultimately the entire fruit were enveloped in a pliable, dark brown decay. A mildly to definitely unpleasant flavour was a feature of the disease in all its phases. The discoloured internal tissues were filled with the dark mycelium and spores of *Alternaria citri* [*R.A.M.*, xv, p. 716; xvii, pp. 25, 389]. The percentage of infected fruits was small, but the difficulty of detecting and removing them in the packing-house lends the disease a certain importance.

LITTAUER [F.]. **Research work in Citrus wastage.**—*Hadar*, xiii, 1, pp. 21, 26, 1940.

More stringent sanitary precautions are stated to be essential for the control of the two most important fungal rots of citrus in Palestine, namely, green mould (*Penicillium digitatum*) and stem-end rot (*Diplodia natalensis*) [*R.A.M.*, xix, p. 88], the chief measures against the former organism being concerned with the cleansing of field boxes, packing-houses, and so forth, while the clearing-up of all dead wood and twigs from the grove is the main line of attack against the latter. Chemical treatment of the fruit, e.g., with 5 per cent. washing soda, considerably reduces the amount of wastage but cannot replace thorough field sanitation. Results to date have shown the necessity for curtailment of the period between picking and shipment, any prolongation of which, especially in the warm weather at the end of the season, leads to the development of rot and the consequent arrival of the fruit in bad condition at its destination, even with satisfactory transit facilities. A clear-cut correlation has further been established between the number of *P. digitatum* spores on the fruit and the amount of wastage, few spores involving only a low percentage of decay even at high temperatures, whereas large numbers increase the incidence of rot. The wilting period should be of medium duration, blemishes tending to develop if it is too short while undue protraction enhances liability to infection.

VIÉGAS (A. P.). **Notas sôbre Septobasidium pseudopedicellatum Burt o causador dum dos feltros dos Citrus no Estado de São Paulo.** [Notes on *Septobasidium pseudopedicellatum* Burt, the agent of Citrus 'felts' in the State of São Paulo.]—*Bol. téc. Inst. agron., Campinas*, 79, 7 pp., 6 figs., 1940.

An account is given of the morphological characters and cytological development of *Septobasidium pseudopedicellatum*, which forms a smooth, grey coating ('felt') over the branches, fruit peduncles, petioles, and lower leaf bases of citrus trees in association with coccids [? *Lepidosaphes pinnaeformis*] in São Paulo, Brazil [*R.A.M.*, x, p. 654; cf. also xv, p. 59]. The writer agrees with Couch [ibid., xviii, p. 59] as to the detrimental effects of the insect-fungus partnership, in its later stages, on the common host, and urges growers to combat it in the local orange groves. When oviposition coincides with the germination of the probasidia, the bulk of the population, if not all, becomes inoculated with the secondary

spores of *S. pseudopedicellatum*. The larvae, traversing the hymenium, settle at the edge of the colony, protected by the subiculum, where they are gradually permeated by the anastomosing hyphae of the fungus, a process involving the extension of the 'felt'. Larval infection has been observed to take place in September or October, after the first rains.

Higgins (B. B.). **Outbreak of Ascochyta blight of Cotton in Georgia.**—*Plant Dis. Reptr*, xxiv, 15, pp. 327–328, 1940. [Mimeographed.]

During July and August, 1940, cotton in some parts of Georgia showed severe infection by *Ascochyta gossypii* [*R.A.M.*, v, pp. 599, 722; ix, p. 240], the leaf spot phase being prevalent throughout the Piedmont and Upper Coastal Plain sections and the stem-lesion phase being noted in Fayette, Spalding, Pike, and Polk Counties. The most severe damage was found in Fayette County, where in certain fields 50 to 90 per cent. of the plants showed stem lesions, and the tops of many were dead. Affected leaves frequently showed pale interveinal areas suggestive of potash deficiency, but analysis of the soils from two badly affected fields showed abundant potassium present.

The first report of the disease was on 12th July, during a period of almost unbroken rain from 3rd to 17th of the month. During the first nine days of this spell, the daily sunshine amounted to less than an hour. The temperature for the period was also abnormally low; on 6th July, for example, it ranged from 61° to 67° F. The disease appears to have been recorded in Georgia only on two previous occasions, in 1914 and 1922. When the rains terminated, the affected leaves fell, and the condition became scarcely noticeable.

With reference to Elliott's suggestion that rotation might control the disease [ibid., ii, p. 216], it is pointed out that the most severely affected field was in wheat followed by cowpeas in 1939.

Miller (P. R.) & Weindling (R.). **A survey of Cotton seedling diseases in 1940 and the fungi associated with them.**—*Plant Dis. Reptr*, xxiv, 13, pp. 260–263, 1 map, 1940. [Mimeographed.]

A further survey of cotton seedling diseases in the United States, carried out in 1940, a season with exceptionally late cold spells [*R.A.M.*, xviii, p. 25], showed that *Glomerella gossypii* was again the predominant organism on seedlings affected with damping-off in the eastern region, whereas in Texas and Oklahoma the fungus occurred on only 4·2 per cent. of the seedlings, compared with 40·6 per cent. for the area east of them. This indicates that *G. gossypii* is of minor importance as a damping-off pathogen in Texas and Oklahoma, though present there in 29·7 per cent. of the fields, as against 89 per cent. for the other States surveyed. Though again broadly distributed in the south-eastern States the fungus was limited to the eastern parts only of Texas and Oklahoma. This distribution coincides with that of the fungus on cotton bolls the previous year [ibid., xix, p. 212].

Of the other fungi isolated, *Fusarium moniliforme* [*Gibberella fujikuroi*], *Rhizoctonia* [*Corticium*] *solani*, *Fusarium* spp., *Alternaria* spp., and *Diplodia gossypina* occurred in 19·3, 1·6, 12·5, 3·5, and 0·6 per cent. of the seedlings, respectively.

EMMONS (C. W.). **Medical mycology.**—*Bot. Rev.*, vi, 9, pp. 474–514, 1940.

Many of the papers included in the bibliography of 311 titles following the author's valuable survey of the present status of knowledge concerning the relations between mycology and clinical medicine have been noticed from time to time in this *Review*. A plea is made for closer co-operation between doctors and mycologists in a hitherto somewhat neglected branch of science of interest and importance to both parties.

DOUB (H. P.). **The roentgenologic aspects of bronchomycosis.**—*Radiology*, xxxiv, 3, pp. 267–275, 5 figs., 1940.

A description is given of some of the more significant pathological changes in the bronchi and lungs revealed by X-ray examination in cases of bronchomycosis associated with blastomycosis, actinomycosis, moniliasis, streptothricosis, and infection by species of *Aspergillus*, *Penicillium*, *Mucor*, and *Oidium coccidioides* [*Coccidioides immitis*: cf. *R.A.M.*, xvii, p. 529; xix, pp. 93, 704]. As a rule the roentgenological diagnosis of fungal invasion requires supplementary confirmation by microscopic study and culture of the sputum, a matter of great importance in view of the liability of confusion between this group of disorders and tuberculosis [ibid., xix, p. 217].

REEVES (R. J.). **The roentgenologic significance of bronchomycosis: case reports.**—*Sth. med. J.* (*J. sth. med. Ass.*), xxxiii, 4, pp. 361–366, 5 figs., 1940.

With a view to stimulating more diligent search for bronchomycoses by means of X-rays [see preceding abstract], the writer describes six cases investigated at the Duke Hospital, Durham, North Carolina, all but one of which gave definite indications of fungal involvement (actinomycosis, blastomycosis, a *Monilia* pathogenic to white rats, *Oidium*, and *M.* [*Candida*] *albicans*). The frequent simulation of tuberculosis and the importance of repeated sputum cultures are emphasized.

KENNEDY (C. B.) & HOWLES (J. K.). **Black hairy tongue: a report of three cases.**—*Arch. Derm. Syph., Chicago*, xlii, 4, pp. 566–569, 1 fig., 1940.

*Monilia* [*Candida*] *albicans* was isolated on Sabouraud's medium at New Orleans in two out of three cases of black hairy tongue [cf. *R.A.M.*, v, p. 301], the patients (males) having laid their cigarettes on wood covered with a similar black growth while working out-of-doors. Reference is made to a fully documented survey of the available information on this disorder by G. Swinburne of Melbourne (*J. Laryng.*, liv, 7, pp. 386–405, 8 figs., 1939).

PENNINGTON (EDNA S.). **A study of the incidence of air-borne molds and of skin sensitivity to molds.**—*Sth. med. J.* (*J. sth. med. Ass.*), xxxiii, 9, pp. 931–938, 3 graphs, 1940.

Daily mould counts were made in August and September, 1937, and from March to the onset of frost in 1938 and 1939 at Nashville, Tennessee, plates of modified Sabouraud's medium being exposed for 10-minute periods. Species of *Alternaria* and *Hormodendrum* predominated

[*R.A.M.*, xix, p. 706], though *Aspergillus*, *Penicillium*, *Mucor*, and *Rhizopus* were also commonly present. In 1937 the *Alternaria* spores reached a peak of 32 per cu. yd. of air on 16th September, and again on 7th October (63). The total mould spore count was made from slides exposed from 1st May to the end of October, 1939. The highest count for any single spore for any day was attained by *H.*, which reached a peak on 12th July of 156 per cu. yd.; the totals for the season were *H.* 1,464, *A.* 744, *Spondylocladium* 122, *Acrothecium* 110, *Fusarium* 96, and *Helminthosporium* 83.

Of 526 patients suffering from seasonal or chronic hay fever and asthma tested intradermally with various mould extracts, 32·5 per cent. gave two plus (abnormally strong) reactions to one or more such extracts and 53·4 per cent. one plus (ordinary positive) reactions. Of the extracts used a commercial preparation of *Hormodendrum* extract produced the most marked reactions, followed by extracts of maize smut [*Ustilago zeae*: loc. cit.], *Penicillium*, *Alternaria*, *Mucor*, *Cephalothecium* [*Trichothecium*] *roseum*, *Monilia sitophila*, *Aspergillus fumigatus*, and *A. niger*. Of 518 patients tested with five strains of *Alternaria*, 36·9 per cent. reacted positively.

DA FONSECA (O.). **Sur l'état actuel de la question des chromoblastomycoses.** [On the present position of the question of chromoblastomycoses.]—*Pr. méd., 1940*, 12, pp. 133–134, 7 figs., 1940.

This is a summing-up of the position to date with regard to the taxonomic status of the chromoblastomycoses, American cases of which are stated to be due to one of four fungi, viz., *Phialophora verrucosa*, *Fonsecaea* or *Hormodendrum pedrosoi*, *H. compactum*, or *H. langeroni* [*R.A.M.*, xvi, p. 812; xix, p. 406], most commonly *H. pedrosoi*. Pending comparative systematic studies between *H. rossicum* [ibid., xviii, p. 109], *H. japonicum*, *Hormiscium dermatitidis* [ibid., xvii, p. 320], and *Torula poikilospora* [ibid., xvi, p. 384], on the one hand, and the organisms associated with diseases of comparable types in the New World on the other, no definite conclusion can be reached regarding the taxonomic position of the Russian and Japanese pathogens.

BONNE (C.). **Conserveering in glycerine van Hormodendrum pedrosoi Brumpt, de schimmel der chromoblastomycose.** [Preservation in glycerine of *Hormodendrum pedrosoi* Brumpt, the chromoblastomycosis fungus.]—*Geneesk. Tijdschr. Ned.-Ind.*, lxxx, 1, p. 26, 1940.

In September, 1939, the writer received at the Batavia (Java) College of Hygiene two tubes of glycerine containing tissues from an abscess above the left knee of a colleague's patient. From this material, which had been at least six days in transit, *Hormodendrum pedrosoi* [see preceding abstract] was readily isolated on Sabouraud's medium and identified by the Centraalbureau voor Schimmelcultures. The preservative properties of glycerine are of interest in this connexion for cultural purposes.

MUSKATBLIT (E.). **Favus: report of six cases.**—*Med. Rec., N.Y.*, cli, 6, pp. 187–192, 4 figs., 1940.

*Achorion schoenleini* was isolated from six cases of favus of the scalp

treated at the New York University College of Medicine from 1930 to 1933. The fungus was cultured on Sabouraud's glucose (4 per cent.)–peptone (1 per cent.)–agar (1·8 per cent.) medium, on which it made slow growth, reaching a diameter of $1\frac{1}{2}$ in. in six weeks; the surface of the brown, convoluted colonies was partly smooth and partly powdery, with spots of whitish velvety down (incipient pleomorphic degeneration), and penetration into the medium was deep, causing one or more radial cracks. Transferred to Sabouraud's 'conservation' medium (3 per cent. peptone, 1·8 per cent. agar, and no sugar), the colonies remained light brown, with a smooth, waxy surface. The fungus showed considerable vitality, one-year-old cultures being successfully transplanted, while one strain is still alive after repeated transfers during a five-year period. The mycelium presented a number of bizarre aspects, including terminal divisions of the hyphal branches into two or three short branches resembling horns and candlesticks, knob-like swellings at the hyphal tips, and pectinate bodies. Three types of spores developed, the most numerous being spherical or ovoid, terminal or intercalary chlamydospores; the spherical, ovoid, piriform, or cylindrical conidia were attached to the sides of simple, unbranched, or slightly branched conidiophores; there were also a few poorly developed spindle-shaped spores with one or two transverse septa.

Levin (E. A.). **Tinea capitis on the Pacific coast.**—*Calif. West. Med.*, lii, 5, pp. 221–222, 1940.

*Microsporon lanosum* [*R.A.M.*, xviii, p. 393 *et passim*] was isolated on Sabouraud's medium (1 per cent. peptone, 1·5 per cent. agar, and 4 per cent. maltose) from 48 out of 58 cases of tinea capitis investigated at the Mount Zion Hospital, San Francisco; one of the remainder yielded *Achorion schoenleini* [see preceding abstract], two gave unidentified fungi, and seven cultures were negative or contaminated.

Batchvarov (B.) & Stoïanov (S.). **Chéilite trichophytique.** [Trichophytic cheilitis.]—*Bull. Soc. franç. Derm. Syph.*, xlvii, 1, pp. 15–19, 2 figs., 1940.

Full details are given of a case of cheilitis due to *Trichophyton violaceum* involving the hands, nails, face, and lips of a 28-year-old farmer in Bulgaria, features of interest in connexion with the disorder being its lengthy duration (20 years), exacerbation of the symptoms in hot weather, and the unusual site of infection on the lips.

Lubchenco (A. E.). **Mycotic infection in northeastern Colorado.**—*Rocky Mtn med. J.*, xxxvii, 10, pp. 741–746, 17 figs., 1940.

Three cases of infection by *Trichophyton* ectothrix microides at Sterling, Colorado, are described in detail, one on the arm of an adult and two on the temples of boys. The fungus is differentiated as follows from *Microsporon* spp., with which it is liable to confusion by reason of two factors common to both, namely, a sheath on the hair and small spores in the sheath. In *T.* ectothrix microides the sheath contains groups of spores 3 to 4 $\mu$ in diameter, whereas the *Microsporon* spores are polygonal, arranged in a mosaic pattern, and do not form chains, while hyphae are absent; within the hair, the mycelium of *T.* ectothrix

microides is straight or slightly curved, the spores occur in chains or small groups, and the filamentous mycelium terminates in a fringe above the bulb; the *Microsporon* mycelium is wavy, branching, 2 $\mu$ in diameter, increasing towards the root and ending in a fringe of Adamson.

RUCHMAN (J.). **Rhinosporidiosis (Seeber): first occurrence in a female in North America.**—*Arch. Otolaryng., Chicago*, xxx, 2, pp. 239–246, 2 figs., 1940.

A description is given of a case of rhinosporidiosis (*Rhinosporidium seeberi*), the fifty-sixth to be reported, the eighth recorded in North America [*R.A.M.*, xix, p. 704], and the first in that region affecting a female.

KUGLER (W. F.) & REMUSSI (C.). **Algunas caracteristicas morfológicas, fitopatológicas y de resistencia a las heladas en variedades agrícolas de Lino cultivadas en la Estación experimental de Pergamino, durante los años 1937 y 1938.** [Some morphological, phytopathological, and frost-resistant characters of the agricultural varieties of Flax cultivated at the Pergamino Experiment Station during the years 1937 and 1938.]—*Publ. Estac. exp. Pergamino* 2, 60 pp., 9 figs., 1939. [English and German summaries. Received November, 1940.]

The following data were obtained in two years' experiments at Pergamino, Argentina, on the reaction to wilt (*Fusarium lini*), rust (*Melampsora lini*), and 'pasmo' (*Phlyctaena linicola*) [*Sphaerella linorum*: *R.A.M.*, xix, p. 707] of 319 varieties and strains of flax, some indigenous and others obtained from different parts of the world. During 1938, wilt was exceptionally severe, causing losses of 30 per cent. and upwards in the stands and reducing germination in susceptible varieties by up to 90 per cent. Apart from a few American varieties, most of those of foreign origin were susceptible, whereas the indigenous lines proved generally resistant, especially 330 and 6906 M.A.

Rust was equally prevalent in both the experimental years, and the only resistant varieties were (Wis. 15) Bombay C.I. 42 and Punjab (Indian type) C.I. 20.

None of the varieties under observation exhibited a noteworthy degree of resistance to *S. linorum*.

FLOR (H. H.). **Soil sickness of Flax in North Dakota.**—*Phytopathology*, xxx, 9, pp. 749–760, 1 fig., 1 graph, 1940.

A tabulated account is given of experiments at Fargo, North Dakota, in 1938 to determine the relation of fungal infection to the 'soil-sickness' complex of flax, as indicated by the development of pathogenic organisms from roots and hypocotyls dug at two- or three-day intervals and plated on potato dextrose agar in Petri dishes. Of the soil-borne organisms considered to be involved in soil sickness, *Fusarium lini* [*R.A.M.*, xvii, p. 395] was responsible for the earliest infection (11 days after sowing) of both wilt-resistant (e.g., Bison) and wilt-susceptible (e.g., Damont) varieties, and in view of this fact and of the preponderance of the fungus in the cultures (425 isolations as compared with 15 of *Alternaria* spp., 16 of *Thielavia* [*Thielaviopsis*] *basicola*, and

4 of *Rhizoctonia* spp.) it is regarded as the primary source of the trouble.

Severe injury was obtained in greenhouse tests on seedlings sown in both steamed and non-steamed soil immediately after inoculation with *R.* spp., the effects of which diminished in successive monthly sowings and were practically negligible in the third sowing in non-steamed soil. Similar observations were made in the case of *Pythium* spp. in steamed soil, but in non-steamed farm soil these organisms caused no apparent injury even when the seed was sown directly after inoculation.

IMLE (E. P.). **What is the situation in Lily diseases?**—*Gdnrs' Chron. Amer.*, xliv, 8, pp. 246, 250, 1940.

Lily mosaic [*R.A.M.*, x, p. 667; xviii, p. 318; xix, p. 411] not being transmissible through the seed, seedling plants grown in isolated sites afford an excellent source of virus-free bulbs. Growers aiming at the complete exclusion of the disease from their gardens cannot compromise with vegetatively propagated bulbs, except possibly those of *Lilium pardalinum*, *L. hansoni*, *L. martagon*, and the Backhouse hybrids. There are, however, two other groups the cultivation of which is open to those willing to harbour the virus, viz., the tolerant, including *L. umbellatum*, *L. elegans*, *L. candidum*, *L. testaceum*, *L. sargentiae*, *L. speciosum*, *L. tauricum*, *L. bulbiferum*, *L. regale* and most of its hybrids, and *L. tigrinum*, and the resistant or immune *L. henryi* and the others mentioned above in connexion with vegetative propagation.

*L. candidum* and *L. testaceum* are subject to severe damage from bulb rot [unspecified], and should not be planted in sites previously occupied by lilies. Sound bulbs in infected beds should be dug when dormant, immersed for 45 minutes in 1 in 100 formalin, and re-planted in a new situation. *Phytophthora cactorum* and *Erwinia carotovora* also cause decay of the underground stem, while *Botrytis* [*elliptica*: ibid., xviii, p. 443] is responsible for foliar blight, which may be destructive in rainy or cool, foggy weather and is controllable by protective sprays of Bordeaux mixture, applied often enough to cover the new leaves as they form.

GIBSON (G. W.) & GREGORY (P. H.). **A Phytophthora blight of bulbous Iris.**—*Trans. Brit. mycol. Soc.*, xxiv, 2, pp. 251–254, 5 figs., 1940.

Since 1928 a leaf blight of bulbous iris (mostly hybrids of *Iris xiphium* and *I. tingitana*) has been observed in the Scilly Isles on the Wedgwood, Imperator, and White Excelsior varieties, and near Penzance on Jacob de Wit. The disease develops in patches several feet in diameter, a severe attack being easily recognizable from a distance. The lower leaves of the affected plants bend over until their ends touch the ground, exposing the pale green, concave inner surface. Closer inspection shows the point of collapse to coincide with the site of necrotic lesions on the outer surface. The younger leaves, higher up on the plant, often bear similar lesions. The whitish spots spread rapidly up and down the foliage: their origin near the bases of the older and outer leaves may be attributable to the retention of water in abundance between the sheathing leaf bases and the stem. The lesions are sharply delimited by parallel vascular bundles along the length of the leaf, but their transverse ends merge indefinitely into the sound tissue. Within the narrow, pale

yellowish-green zone at the transverse ends of the lesion is a light purplish-brown or greyish-white area, contrasting sharply along the longitudinal edge with the normal dark green of the foliage. The extreme tips of the leaves are not infected, but they wither in the presence of extensive lesions lower down. On the inner leaf surface the lesions are purplish-grey and relatively inconspicuous. Towards the end of the growing season (in Wedgwoods), the lower lesions extend down below soil-level towards the new bulbs formed within the shrivelled skin of the parent bulb. The prominent, dark purplish-brown lesions developing on the blanched surface of the lower sheathing leaf bases and stem contain large hyphae, rich in protoplasm, which may reach the young bulbs and overwinter on them, causing fresh outbreaks of infection in the spring. Spread from plant to plant is fairly slow, diseased bulbs left in the soil giving rise to blighted patches the following season; the plants in these areas are often very stunted and tend to die out.

The causal organism of the disease, characterized by beaked, applanate sporangia, 37 to 66 by 24 to 40 $\mu$, borne in compact clusters on short sporangiophores, furnished with short, occluded pedicels, and containing feebly motile zoospores, 8 to 12 $\mu$ in diameter, was tentatively identified by S. F. Ashby as a species of *Phytophthora* related to *P. cyperi-rotundati* [*R.A.M.*, vii, p. 273]. Overwintered leaves bore oogonium-like bodies, 32 to 44 $\mu$ in diameter, containing structures 27 to 35 $\mu$ in diameter presumed to be oospores; no antheridia were detected, so that the connexion between these elements and the iris pathogen could not be established. Attempts to culture the organism and inoculation experiments gave negative results.

In addition to plant sanitation measures, it is suggested that light applications of a fungicide might be effective against the blight in outdoor plants, while under glass the avoidance of overhead irrigation appears to have prevented infection, but methods of control have not yet been fully worked out.

JEFFERS (R. H.). **Gladiolus diseases. II. Gladiolus dry rot (Sclerotium gladioli). III. Gladiolus hard rot (Septoria gladioli).**—*Gladiol. Annu., 1940*, pp. 28–30, 1940.

Popular notes are given on the symptoms and control of the dry and hard rots of gladiolus (*Sclerotium* [*Sclerotinia*] *gladioli* and *Septoria gladioli*, respectively) in Great Britain. Since *Sclerotinia gladioli* [*R.A.M.*, xiii, p. 581; xviii, p. 726; xix, p. 559] persists in the soil for at least four years, the host should be excluded from the rotation on their original site for this period wherever contamination is suspected. Only sound corms should be used for planting, and during the growing season all affected plants should be pulled up and burnt. The corms should be carefully examined for signs of infection, not only at lifting but also during storage; their immersion in mercuric chloride is stated to have given good results but the method is not recommended for amateur growers.

Control measures against *Septoria gladioli* [ibid., xiii, p. 493; xvii, p. 113] should be directed towards the prevention of the spread of infection from diseased to healthy leaves by means of the spores and of the infection of the corms by mycelium in the soil. For the former

purpose weekly applications of Bordeaux mixture to the foliage from mid-July to the end of August or early September have been found satisfactory, while the selection of corms and the utilization of new sites are the only practicable measures against soil infection.

TISDALE (W. B.). **Did Botrytis actually cause Gladiolus blight in Florida?**—*Plant Dis. Reptr*, xxiv, 14, pp. 285–287, 1940. [Mimeographed.]

The gladiolus blight attributed by Dimock to *Botrytis cinerea* [*R.A.M.*, xix, p. 539] was evidently, from his description of the symptoms, the identical disease investigated by Florida plant pathologists during March and April, 1940, and found to show no consistent association with any organism, an observation corroborated by the examination of growers' samples at the Bureau of Plant Industry. Several exceptional environmental factors were in operation during the outbreak, but so far there is no evidence to prove either that they intensified the severity of infection, or that *B. cinerea* (unless the existence of an unfamiliar strain is postulated) was primarily concerned in the development of the blight.

TOMPKINS (C. M.) & HANSEN (H. N.). **Tulip anthracnose.**—Abs. in *Phytopathology*, xxx, 9, p. 790, 1940.

Darwin tulips (*Tulipa gesneriana* var. *darwinia*) are affected at Burlingame, California, by anthracnose of the leaf blades and peduncles. Water-soaked, later dry, black-edged, elliptical lesions of varying size are formed parallel to the long axis of the peduncle. The fungus isolated from the diseased tissues on potato dextrose is regarded as a new form (*tulipae*) of *Gloeosporium thumenii* [but is not described]. Inoculation experiments with spore suspensions gave positive results after an incubation period of 7 to 10 days on young tulip plants, reisolates from which were likewise pathogenic. In nature, the Reverend Eubank and Zwanenburg varieties are highly susceptible, while Clara Butt and Fantasy (a parrot type) are immune.

WHETZEL (H. H.) & DIMOCK (A. W.). **Sclerotinia sclerotiorum on Calceolaria.**—*Plant Dis. Reptr*, xxiv, 14, pp. 284–285, 1940. [Mimeographed.]

*Sclerotinia sclerotiorum* was isolated from *Calceolaria* plants in western New York suffering from a wilt of the leaves, some of which showed irregular, necrotic areas extending from the petiole into the lamina; the stems were dry and crumbly and the pith was replaced by the cottony mycelium and black sclerotia of the pathogen. Apothecia were formed on sclerotia in the soil and cinder substratum upon which the pots were placed. At least 75 per cent. of the grower's stock of several thousand plants suffered from the disease.

SAMPSON (KATHLEEN) & WESTERN (J. H.). **Two diseases of grasses caused by species of Helminthosporium not previously recorded in Britain.**—*Trans. Brit. mycol. Soc.*, xxiv, 2, pp. 255–263, 2 figs., 1940.

A disease of perennial rye grass (*Lolium perenne*), *L. multiflorum*, and

*Festuca pratensis* in England and Wales, characterized by oval, chocolate-coloured spots with white centres or dark streaks 1 cm. or more in length on the leaf blades, sometimes involving complete destruction of the mesophyll and collapse at the site of infection, distorted and discoloured spikes, and bleached glumes, was attributed in 1922 to *Helminthosporium gramineum* [*R.A.M.*, i, p. 422], but has now been found to be due to *H. siccans* [ibid., xiv, p. 515]. The fungus was readily isolated and preliminary inoculation experiments [which are described in detail] clearly indicated that it is able to pass from rye grass to meadow fescue and vice versa, though the problem of its physiologic specialization was not fully investigated.

The average dimensions of the subhyaline conidia from *L. perenne* plants were 109 by 16·5 $\mu$, with 6·7 septa, the corresponding figures for *L. multiflorum* and *F. pratensis* being 95·9 by 13·6 $\mu$ and 5·6 septa, and 88·9 by 14·8 $\mu$ and 5·3 septa, respectively. In culture the average size of the conidia from *L. perenne* ranged from 55·6 to 72·3 by 13·5 to 15·4 $\mu$, with 3·2 to 4·2 septa, those from *L. multiflorum* from 44·6 to 65·2 by 13·2 to 14·3 $\mu$, with 3·1 to 4·3 septa, and those from *F. pratensis* from 53·9 to 78·2 by 11·2 to 14·9 $\mu$, with 3·9 to 4·6 septa. Drechsler's measurements for *H. siccans* from both *L.* spp. were 80·1 by 16·8 $\mu$, with 4·9 septa. Most of the conidia from *L. multiflorum* in the Aberystwyth material were of the tapering type, those of *L. perenne* tended towards the cylindrical, while of six cultures of *F. pratensis* three produced tapering and three cylindrical spores.

A fungus causing dark purplish-red lesions, with light brown, finally white centres on the leaf blades of *Poa pratensis* at Aberystwyth and on material supplied by Dillon Weston, was identified as *H. vagans* [ibid., ix, p. 596], soil inoculation experiments with which gave positive results on the same host only. In pot experiments the pathogen caused the formation of brown lesions on the white underground rhizomes and obviously interfered with the natural spread of the plant. The average dimensions of the conidia from *P. pratensis* plants (Aberystwyth) were 132·5 by 18·2 $\mu$, with 10·2 septa, the corresponding figures for those from tap water agar being 69·5 by 17·8 $\mu$, with 5·5 septa, and for Drechsler's specimens 82·7 by 19·1 $\mu$, with 6·3 septa. Unlike *H. siccans*, *H. vagans* grows rather slowly in culture, forming on potato dextrose agar an olive-green aerial mycelium with few spores, which developed in larger numbers, though still somewhat sparsely, on tap water agar.

Glasscock (H. H.). **Blind seed disease of Rye-Grass.**—*Nature, Lond.*, cxlvi, 3698, pp. 368–369, 1940.

Examination of 27 samples of rye grass [?*Lolium perenne* and/or *L. multiflorum*] seed from east Kent showed that 25 contained seeds which bore on the caryopsis conidia agreeing with those described by Neill and Hyde as being produced by the blind seed fungus [*Helotium* sp.: *R.A.M.*, xviii, p. 601; xix, p. 709]. Cultures and selected seeds were sent to Neill, who expressed the opinion that the former appeared to be identical with those obtained in New Zealand, and that the latter were typically affected. This evidence indicates that the condition is widely prevalent in east Kent. Infected seeds sown in pots of sterilized soil in a glasshouse produced apothecia agreeing with the description of those

seen in New Zealand and exactly like those figured by Muskett and Calvert.

Goto (K.). **Sclerotinia libertiana on Buckwheat.**—*Ann. phytopath. Soc. Japan*, ix, 4, pp. 263–265, 3 figs., 1939. [Japanese. Abs. in *Biol. Abstr.*, xiv, 7, p. 1208, 1940.]

Sclerotia detected among buckwheat seed in 1937 were found to be almost identical with those of *Sclerotinia libertiana* [*S. sclerotiorum*], the specific differentiation of which from *S. fagopyri* is regarded as of doubtful validity. The pathogenicity of the buckwheat fungus was demonstrated by inoculation tests.

Steyn (D. G.). **Poisoning of stock by fungus-infected Paspalum grasses.**—*Fmg S. Afr.*, xv, 174, pp. 340, 344, 1940.

Under veld conditions in South Africa poisoning with *Claviceps paspali* following feeding on infested *Paspalum* grass pastures [*R.A.M.*, xviii, p. 460] usually affects only cattle, but feeding tests have shown that horses and sheep are also liable to be poisoned by the fungus, which was found to be more dangerous in its mature than in its sphacelial stage. The same animal can be repeatedly affected by poisoning without becoming resistant. The poison affects the nervous system, leading in severe cases to complete paralysis and death. Recovery may take either a few days or weeks provided the animals are immediately removed from contaminated grass or hay, dosed with a good purgative, and given very strong black coffee. It is pointed out that *Paspalum* grass and hay are of exceptional value for the farmer and that the following preventive measures should be carried out to ward off poisoning: grazing on *Paspalum* pastures should be allowed only as long as the grass is young; pastures should be thoroughly examined for the presence of *C. paspali* before stock are allowed to graze on them, and in cases where slightly or fairly heavily infested pastures must be used by reason of scarcity of food, the animals should be run for a day or two on the infected pasture and then removed for a few days, or the contaminated hay should be mixed with sound material. It should also be remembered that silage is probably less dangerous than fresh infected grass or hay. Those areas in the pastures or those parts of the hay which are heavily infected with the fungus should be removed and burned.

Crowell (I. H.). **The geographical distribution of the genus Gymnosporangium.**—*Canad. J. Res.*, Sect. C, xviii, 9, pp. 469–488, 43 maps, 1940.

Species of the genus *Gymnosporangium* [*R.A.M.*, xix, pp. 374, 677] are stated to be confined almost entirely to the temperate portion of the northern hemisphere. The genus is composed of 48 species, 33 occurring in North America, 15 in Asia, and 6 in Europe, including north Africa. Each of the three continents has a distinctive *Gymnosporangium* flora, with the exception of three species, *G. aurantiacum*, *G. clavariaeforme*, and *G. juniperinum*, which occur in all three of them. In the North American region two geographical areas are evident. The eastern, extending from the Atlantic ocean to the foot-hills

of the Rocky Mountains, harbours among others *G. clavipes*, *G. juniperi-virginianae*, *G. globosum*, and *G. exiguum*, while in the western region *G. cupressi*, *G. guatemalianum*, and *G. inconspicuum* are of interest. Species of the European region include *G. sabinae*. The *Gymnosporangium* flora of North America is classified in four categories as follows: (i) species that occupy all potential territory covered by the coincident ranges of their alternate hosts, (ii) species restricted by the range of their 'primary' teleuto host, (iii) localized species confined within a portion of the coincident ranges of their alternate host, and (iv) widely distributed species not limited in their range by either alternate host group.

Husz (B.). **Megfigyelések az Almafa törpeszárúságáról.** [Apple rosette in Hungary.]—*Bull. R. Hung. hort. Coll.*, N.S., i, pp. 11–36, 15 figs., 1940. [English summary.]

During the past five years apple trees growing under unfavourable (sub-arid) climatic conditions on black alkali soils of Hungary have been suffering from rosette [little leaf: *R.A.M.*, xii, p. 99], the symptoms agreeing with those described by O. M. Morris in 1923 [ibid., iii, p. 341]. Observations and experiments to date have confirmed the results of American tests demonstrating the non-contagious and non-graft-transmissible character of the disorder, which proved amenable to control, however, by spraying with zinc sulphate from April to July, or by injections of the same compound [ibid., xvii, p. 692], the maximum benefit being secured in an orchard previously fertilized with stable and synthetic manures. Zinc deficiency appears to fall into two categories, permanent and temporary, the latter being largely dependent on weather conditions, such as the sum-total of winter precipitation, evidently the factor responsible for the serious development of little leaf in the spring of 1939.

Bauer (K.) & Huber (G. A.). **The use of calcium cyanamid and other fertilizer materials and soil amendments in the destruction of apothecia of Sclerotinia fructicola with methods of application.**—Abs. in *Phytopathology*, xxx, 9, p. 785, 1940.

Aqueous solutions of ammonium sulphate, sodium nitrate, and urea, though severely injuring the apothecia of *Sclerotinia fructicola* [at the Western Washington Experiment Station: *R.A.M.*, xviii, p. 603] failed to prevent their subsequent development, neither was effective control afforded by the application, immediately before the emergence of the apothecia, of ammonium sulphate, hydrated lime, urea, or calcium carbonate. The fruiting bodies were suppressed only by the use of calcium cyanamide [loc. cit.].

Maier (W.) & Mittmann-Maier (Gertrud). **Monilia cinerea Bon. als Erreger einer Blattkrankheit an Süßkirsche.** [*Monilia cinerea* Bon. as agent of a leaf disease of Sweet Cherry.]—*Angew. Bot.*, xxii, 1, pp. 79–85, 7 figs., 1940.

A wild sweet cherry tree near Geisenheim (Rhine) was observed in May, 1939, to be affected by a foliar and branch wilt, the shrivelled leaves being covered with the yellowish-grey mycelium and spore

pustules of *Monilia cinerea* [*Sclerotinia laxa*: *R.A.M.*, xix, p. 479] and the branches exuding gum. Inoculation experiments with malt agar cultures of the fungus on plums, apricots, and peaches resulted in the development of the typical mycelium of *S. laxa*, whereas apples and pears reacted negatively, or at most very sparsely, to the same treatment. These observations, together with the data from comparative conidial measurements, satisfactorily established the identity of the organism with *M. cinerea* [*S. laxa*]. The conidia of *S. laxa* from sweet cherry leaves on apple, pear, and peach measured $14{\cdot}8\pm1{\cdot}1$ by $10{\cdot}7\pm0{\cdot}9$, $16{\cdot}3\pm1{\cdot}5$ by $12{\cdot}2\pm1{\cdot}1$, and $17{\cdot}9\pm1{\cdot}7$ by $13{\cdot}3\pm1{\cdot}2$ $\mu$, respectively, those of the same from apricot mummies on the three inoculated hosts $15{\cdot}8\pm1{\cdot}2$ by $10{\cdot}2\pm0{\cdot}9$, $15{\cdot}3\pm1{\cdot}5$ by $10{\cdot}7\pm1{\cdot}1$, and $16{\cdot}3\pm1{\cdot}8$ by $11{\cdot}7\pm1{\cdot}0$ $\mu$, respectively, and those of *M.* [*S.*] *fructigena* from apple on apple, pear, and peach $21{\cdot}4\pm1{\cdot}8$ by $14{\cdot}3\pm1{\cdot}3$, $20{\cdot}4\pm1{\cdot}7$ by $13{\cdot}8\pm1{\cdot}3$, and $20{\cdot}4\pm2{\cdot}5$ by $14{\cdot}3\pm1{\cdot}4$ $\mu$, respectively (means of 200 in all cases).

The sweet cherry leaf strain of *S. laxa* is characterized in malt agar cultures by scanty conidial production and an abundance of chlamydospores of the most diverse shapes and sizes, non- or uniseptate, elongated, filiform elements or concatenate spores, separated by short segments of mycelium, indistinguishable from the conidia.

Evidence was obtained that infection originates in leaves of varying stages of maturity and thence proceeds to the petiole and branch, girdling the latter, with consequent wilting. Brown, expanding lesions, similar to those observed in nature, were formed in a few days on the leaves of cut cherry branches sprayed with a conidial suspension of the fungus and held at 20° to 22° C. in a moist chamber. On removal to a drier atmosphere the leaves shrivelled. Concentric zones, resembling those formed in culture, developed on some of the leaves, but no conidial cushions. The invasion of the pathogen was followed through the petiole into the branch.

This is believed to be the first record of a foliar wilt of cherries due to *S. laxa* in Germany, or Central Europe generally. The potentialities of the disease are serious, but their realization is likely to depend on the prevalence of propitious weather conditions, especially in regard to humidity.

Reeves (E. L.). **Rusty-mottle, a new virosis of Cherry.**—Abs. in *Phytopathology*, xxx, 9, p. 789, 1940.

The binomial *Marmor rubiginosum*, following Holmes's system of virus nomenclature [*R.A.M.*, xviii, p. 607], is proposed for a graft-transmissible disease of sweet cherries, commonly known as 'rusty mottle', characterized by a chlorotic mottling of the small basal leaves developing four or five weeks after full bloom and the subsequent rapid appearance of late-season colours ranging from bright yellow to red. The symptoms gradually extend to the older leaves, and during the seventh and eighth weeks after full bloom 30 to 70 per cent. of the foliage is shed. At this juncture the mottling of the remaining leaves becomes more intense, and yellowish-brown areas impart a generally rusty aspect. Affected trees bear small, late-maturing, and insipid fruits, and there is a slow decline of vitality. The disease, which is attributed on the basis of the available evidence to a virus, has repeatedly

been transmitted during the last five years by various methods of grafting, but not by juice inoculation.

Woods (M. W.) & Haut (I. C.). **Mild streak disease of Black Raspberries in Maryland.**—*Plant Dis. Reptr*, xxiv, 16, pp. 338–340, 1940. [Mimeographed.]

In some Maryland black raspberry [*Rubus occidentalis*] plantings the most destructive disease is mild streak [*R.A.M.*, xii, p. 230], which occurs locally on the Cumberland, Logan, Dundee, Black Diamond, Naples, Quillen, Evans, Bristol, and Shuttleworth varieties, but not on Black Beauty, even when growing in close proximity to severely infected bushes.

The condition is not easily detected. The cane symptoms are most readily recognized during a period that extends from shortly before the fruit ripens until the new canes begin to show a normal colour. The streaks (which are often found within about 1 ft. of the ground on new canes, but which may develop on laterals or just behind the tips) are purple to violet and usually pronounced on Dundee, Bristol, and Logan, greenish-brown on Naples, and bluish, but generally very distinct, on Evans. They appear as single lines, but in reality are narrowly elliptical, enclosing, as a rule, a small central island of apparently normal surface. If the bloom is rubbed away, the epidermis appears water-soaked and discoloured. Sometimes only a few isolated streaks are present, but the entire cane may be so heavily streaked as to appear water-soaked all over. In many instances the streaks are exceedingly faint. The leaves near the tips of the new canes are often slightly curled. Vein-clearing is frequently present. The berries are lustreless, dry, and of poor flavour. If an inspection is made at or after mid-season, the condition can be diagnosed in the year the plants are set. Leaf symptoms are of special value in identification on young plants. In some varieties, such as Cumberland and Dundee, the leaves on the new canes are curled, and have a greasy, rugose appearance, the latter symptom also being apparent sometimes on older plants. Vein-clearing of leaves formed on the 'handles' is a valuable aid to detection in young sets. With Dundee and Cumberland the old 'handles' should be allowed to remain until they leaf out, so that affected plants can be detected by the vein-clearing symptom and rogued out.

Field evidence indicated that the condition may spread rapidly over distances up to 20 ft. and slowly over greater distances (about 200 ft.). The disease is likely to become a serious factor in raspberry production. Roguing is considerably more difficult than for any other raspberry virus disease. Inspections must not be made too early in the season, and attention must be given to varietal differences in symptom expression. A very thorough hill-by-hill inspection must always be made.

Stevens (H. E.). **Papaya diseases.**—*Proc. Fla hort. Soc.*, lii, pp. 57–63, 1939. [Abs. in *Biol. Abstr.*, xiv, 7, p. 1209, 1940.]

The chief diseases of papaw in Florida, viz., leaf blight (*Pucciniopsis* [*Asperisporium*] *caricae*) [*R.A.M.*, xvii, p. 17; xviii, p. 478], powdery mildew (*Oidium*) [*caricae*: ibid., xviii, pp. 506, 712], damping-off (*Rhizoctonia* sp.), and fruit rot (*Colletotrichum* [? *gloeosporioides*: ibid.,

xix, p. 663]) are described, and measures for their control suggested. A brief discussion is also given of foreign diseases of the same host, especially those not known to have become established in the United States.

RADA (G. G.). **La enfermedad de la 'antracnosis del Mango'.** [The anthracnose disease of Mango.]—*Circ. Estac. exp. agríc. La Molina* 50, 6 pp., 3 figs., 1939. [Received September, 1940.]

This is a popular description of mango anthracnose (*Glomerella cingulata*) [*R.A.M.*, xix, pp. 611, 663], which is stated to cause severe damage in the Chanchamayo region of Peru with its heavy annual rainfall, and to be present also in the vicinity of Lima, where precipitation is less intensive but the humid and misty atmospheric conditions are favourable to infection. Control may be effected by plantation hygiene, supplemented by the application of 0·75 per cent. Bordeaux plus an adhesive, e.g., $\frac{1}{4}$ kg. wheat flour or 1 l. skimmed milk per 100 l. of the mixture, the treatments to be given at intervals of two to three days during the blossoming period and thereafter fortnightly or monthly for the protection of the developing fruits.

ARRUDA (S. C.). **Antracnose e cancro das Anonaceas.** [Anthracnose and canker of the Annonaceae.]—*Biologico*, vi, 8, pp. 224–225, 1940.

A representative of the Annonaceae ['fruta-de-conde'] is reported to suffer from two diseases in Brazil, viz., anthracnose (*Colletotrichum gloeosporioides*) [*Glomerella cingulata*: cf. *R.A.M.*, vii, p. 20] and a canker of uncertain origin. *G. cingulata* forms dark chestnut to nearly black, circular or elongated spots on the leaves; sunken, elongated lesions on the young shoots, causing desiccation of the apical portion and the production, below the site of infection, of up to five adventitious buds, which are attacked in turn; and dark chestnut spots on the fruits, inducing rapid decay at maturity. Cotton in Brazil has recently sustained severe damage from *C. gossypii* var. *cephalosporioides*, causing foliar malformation, the production of an excessive number of shoots, and finally complete deformation and sterility [ibid., xviii, p. 798]. This fungus, though morphologically closely similar to *C.* [*G.*] *gossypii*, produces pathological symptoms more suggestive of those observed on the Annonaceae.

The cankers, with which a species of *Fusarium*, other fungi, and a bacterium were associated, cause a cracking of the bark along their entire extent; inoculation tests have so far given negative results.

MCCALLAN (S. E. A.) & WILCOXON (F.). **An analysis of factors causing variation in spore germination tests of fungicides. II. Methods of spraying.**—*Contr. Boyce Thompson Inst.*, ii, 4, pp. 309–324, 4 figs., 5 graphs, 1940.

The object of the present study was to find an accurate method of spraying in laboratory tests of fungicides [*R.A.M.*, xix, p. 665] which would permit the application of a known amount of fungicide to glass slides in a reproducible manner. The following four methods were compared with regard to their relative precision: (*a*) free-hand spraying

with a de Vilbiss No. 15 bulb atomizer; (*b*) free-hand spraying with controlled pressure and time, the atomizer being attached to the laboratory air pressure line and the pressure regulated by means of a manometer; (*c*) various types of stationary horizontal sprayers, of which the most satisfactory was a cellophane-covered chamber with the glass slide mounted about 30 in. from an atomizer nozzle, the spray suspension being stirred continuously, applied at a constant pressure, and the amount of deposit regulated by varying the time of spraying; and (*d*) settling towers. A simple home-made settling tower and a permanently installed stainless steel one were developed, both being 1 ft. square at the base and 5 ft. high. The spray is directed up into the tower, the nozzle then withdrawn, some time allowed for the large drops to settle, and finally the slides inserted on a tray to receive a uniform coating of fine spray. The amount of deposit on the slide can be regulated by the number of exposures. The most satisfactory results in working with the settling tower were obtained with 30 seconds' spraying at 10 lb. pressure, 10 seconds' settling, and 60 seconds' exposure of the slide. The four methods were compared by means of dye tests, brilliant blue being sprayed on the slides, then washed off and the amount determined in a colorimeter. Each method was tested in five replicate tests on different days, on four replicate slides each time, and at four different doses. The coefficients of variation for slides sprayed at the same time and at different times for the four methods, respectively, were (*a*) 16·7 and 85·2 per cent., (*b*) 7·0 and 43·4, (*c*) 5·9 and 30·1, and (*d*) 4·5 and 13·7; the variances for replicate slides within doses, 76 degrees freedom, were (*a*) 148·86, (*b*) 22·57, (*c*) 10·25, and (*d*) 4·33. The differences between the methods were highly significant; thus (*b*) represented a nearly sevenfold increase in precision over (*a*), (*c*) a twofold increase over (*b*), and (*d*) about another twofold increase over (*c*) and a greater than thirtyfold over (*a*).

A comparison of observed deposit of various copper fungicides in the settling tower with that expected from calibration by the dye test showed an average agreement within 5·4 per cent. The results of comparative spore germination tests with the $\chi^2$ test for linearity of dose-effect curve, steepness of slope, and reproducibility as criteria for evaluating precision indicated the settling tower to be the most precise of the four spraying methods tested. It is concluded from dye and spore germination tests that the settling tower method is the most accurate, followed in order by stationary horizontal sprayers, free-hand spraying with controlled pressure and time, and free-hand spraying with bulb atomizer.

BEVER (W. M.) & SEELY (C. I.). **A preliminary report on a fungus disease of the field Bindweed, Convolvulus arvensis.**—*Phytopathology*, xxx, 9, pp. 774–779, 3 figs., 1940.

A species of *Rhabdospora*, characterized by pycnidia with walls composed of several layers of brown, parenchymatous cells, and hyaline, filiform, straight or slightly curved, pluriguttulate, continuous to uniseptate pycnospores, 35 to 37 by 1 $\mu$, has been isolated from dark brown, hard lesions, up to 2 or 3 in. long, on *Convolvulus arvensis* stems in Idaho and Washington. Infection first shows in the centre of a

bindweed patch, where the plants become diseased and gradually die. Lesions up to 2 or 3 in. in length occur at any point on the stem in close proximity to the soil. The leaves turn yellow or become water-soaked and die, very little seed is set, and there is a reduction in the size of the roots, which in extreme cases may also be attacked. The fungus, not hitherto recorded on the host in question, grows best at 20° C., the minimum and maximum temperatures for its development being 4° and 36°, respectively. It was shown by inoculation experiments to be soil-borne.

HOAGLAND (D. R.). **Minute amounts of chemical elements in relation to plant growth.**—*Science*, N.S., xci, 2372, pp. 557–560, 1940.

The author discusses, with frequent references to pertinent literature, the growing appreciation of the importance of minute amounts of minor elements in plant nutrition, and stresses the necessity of co-operative research on the part of plant and animal physiologists, soil chemists, and possibly plant breeders, for the study of quality deficiencies in crops, and the feasibility of modifying the quality by commercially practicable procedures.

BENNETT (C. W.). **The relation of viruses to plant tissues.**—*Bot. Rev.*, vi, 9, pp. 427–473, 1940.

In the course of this useful review three groups of viruses are distinguished, viz., those restricted to the parenchyma (the smallest group, which includes phony peach virus); those closely associated with the phloem (e.g., raspberry leaf curl and beet curly top viruses); and those which occur in both phloem and parenchyma (e.g., all viruses of the mosaic-producing type). Absence of seed transmission is not surprising with viruses restricted to the phloem, since there is no vascular connexion between the embryo and mother plant. The inability of viruses to enter or remain active in microspores and megaspores is suggested as an explanation of the freedom from seed transmission of viruses which occur in the parenchyma. This hypothesis is supported by the facts that pollen infection is associated with all cases of seed transmission that have been adequately investigated and no virus not seed-transmitted is known to occur in pollen. Most of the papers cited in the four-page bibliography have already been noticed in this *Review*.

TIMONIN (M. I.). **The interaction of higher plants and soil-microorganisms. II. Study of the microbial population of the rhizosphere in relation to resistance of plants to soil-borne diseases.**—*Canad. J. Res.*, Sect. C, xviii, 9, pp. 444–455, 2 pl., 1 diag., 1940.

The second contribution to this series [*R.A.M.*, xix, p. 669] contains an expanded account of studies on the microbial population of the rhizospheres of flax and tobacco resistant or susceptible to wilt [*Fusarium lini*] and black root rot [*Thielaviopsis basicola*], respectively, the results of which have already been noticed in part from another source [ibid., xix, p. 422]. Little difference in the abundance of micro-organisms was exhibited by the rhizospheres of the same varieties of oats, mangels, and clover grown in plots receiving no fertilizer and by those receiving 15 tons of farmyard manure per acre, even though the soils varied

greatly in productivity. It is concluded that the type of crop is of much greater significance than the degree of soil fertility in determining the abundance of microbial population in the rhizosphere. Differential counts of fungi and Actinomycetes indicated that colonies developing from spores or conidia represent only small fractions of the total count, namely, 6 to 8 per cent. It was also evident that sporulation is greater in the soil distant from the roots than in the rhizospheres. Examination of contact slides indicated a greater number of micro-organisms in the rhizosphere of flax than in the soil distant from the roots and showed the same differences between the rhizosphere populations of resistant and susceptible varieties as demonstrated by the plating method.

McIntosh (T. P.). **The importance of the variety in Potato production.**—*Gdnrs' Chron.*, Ser. 3, cvii, 2776, pp. 116–117; 2777, p. 132, 1940.

Among the varietal characters of potatoes requiring special consideration in connexion with commercial breeding schemes are such pathological but apparently non-infectious variations as 'bolters' (abnormally tall and late-maturing, with peculiar foliar features) and 'wildings', the late Prof. Murphy's view of which as infected by the witches' broom virus [*R.A.M.*, xvii, p. 833] is not shared by the writer. Certain types of 'wildings' are believed to represent periclinal mutations, whereas the anomalies associated with 'bolting' are of quite a different order. 'Bolters' have been experimentally obtained from normal plants by the use of top cuttings. Notes (based in part on information supplied by G. Cockerham) are given on varietal reaction to virus diseases in Scotland [ibid., xix, p. 670], and on the development of varieties immune from *Phytophthora infestans* and other fungi [ibid., xix, p. 723.].

**Trials of Potatoes for immunity from wart disease, 1939.**—*J. Minist. Agric.*, xlvii, 2, pp. 135–136, 1940.

A descriptive list is given of six new potato varieties found in trials conducted by the Ministry of Agriculture to be immune from wart disease [*Synchytrium endobioticum*: *R.A.M.*, xix, pp. 320, 564], comprising Doon Castle, Vanguard (early), Doon Bounty, Doon Well (second early), Bellahouston (early maincrop), and Doon Eire (late maincrop).

Bonde (R.), Stevenson (F. J.), & Clark (C. F.). **Resistance of certain Potato varieties and seedling progenies to late blight in the tubers.**—*Phytopathology*, xxx, 9, pp. 733–748, 4 figs., 1940.

Further laboratory and field studies in Maine during 1937–8 on the varietal reaction of potatoes to late blight (*Phytophthora infestans*) [*R.A.M.*, xvii, p. 267] are described and tabulated. In laboratory tests in 1937 Earlaine and Green Mountain proved highly susceptible to tuber infection, whereas Paisley No. 2, President, and Ekishirazu were resistant, though tubers of some lots of the last-named (10 per cent.) underwent a slow decay. The progeny of the cross Paisley No. 2 × Earlaine showed wide variations in reaction to the pathogen, 42·9 per cent. being free from tuber decay, 11·5 developing infection which progressed at a slow rate, while 45·6 fell into highly susceptible Green Mountain

category. Little more resistance was shown by the offspring of Paisley No. 2 × Ekishirazu than by the foregoing. In field experiments in 1938 the parent varieties Russet Rural, Earlaine, and Katahdin and the Green Mountain controls were very susceptible to tuber infection, Hindenburg and Richter's Jubel somewhat less so, while the tubers of the vine-resistant varieties (336–144), (336–18), President, and Paisley No. 2 were not infected. The fact that 22 per cent. of the seedlings derived from selfing Katahdin were resistant to tuber decay is considered to reveal the existence in this phenotypically susceptible variety of a factor for resistance to tuber rot. Evidence was also obtained that Earlaine, like Katahdin, though itself susceptible, evidently carries one or more factors for resistance.

Tuber and vine resistance were found to be correlated in the progenies of Katahdin selfed, Hindenburg × Katahdin, (336–144) × (336–18), and President × Earlaine, but not in those of Paisley × Earlaine or Richter's Jubel × S. 44537. These and other data relative to the grouping of tuber and foliar infections denote that resistance to the two categories is conditioned by different genetic factors. Some varieties remain free from attacks on the leaves on account of certain growth habits or morphological characteristics, while infection of the tubers may be limited by peculiarities in the structure of the periderm or lenticels. In other cases resistance was apparently of a physiological order, the fungus making slow growth and only fruiting sparsely after infection. The tubers of some varieties, susceptible when young, acquire resistance with advancing maturity. No indication was obtained of any increase in the virulence of *P. infestans* through propagation on the resistant President and Sebago varieties, the reaction of which, and of several seedling types, has remained unchanged over a ten-year period in Aroostook County, contrasted with infection percentages of 20 to 70 per cent. in Green Mountains in the same series of experiments.

MICHEL (W.). **Versuche zur Schaffung einer einfachen Methode für die Prüfung des Verhaltens verschiedener Kartoffelsorten gegen Schorf.** [Attempts at the origination of a simple method for testing the reaction of different Potato varieties to scab.]—*Angew. Bot.*, xxii, 2, pp. 133–146, 1940.

Following up the work of Noll [*R.A.M.*, xix, p. 111] and previous investigators on the factors determining the varietal reaction of potatoes to scab [*Actinomyces scabies*], the writer describes the method employed in a series of tests initiated at the Landsberg (Warthe) Agricultural Experimental Station, Germany, in 1938, and tabulates the results. Thirty-three varieties were included in the trials, 10 more or less resistant and 23 susceptible. The tubers were grown in scab-free soil, and great care was taken to exclude any possibility of injury to the skin which might disturb the normal course of transpiration, this being the criterion applied in the appraisal of the relative resistance or susceptibility of a given variety. Transpiration was determined by the relative loss of weight of single tubers of resistant and susceptible varieties exposed to a current of air, a susceptible tuber being placed on one pan of a balance with a resistant one on the other. The difference in the rates of transpiration was usually evident within an hour, at the end of

which the equilibrium was restored and a further test made. Importance was attached to uniformity in the matters of time of maturity and tuber weight and size, and a minimum of ten tests was reckoned necessary to establish the transpiration relations of one pair of varieties.

Of the first 266 experiments, 242 (91 per cent.) gave positive results, that is to say, the tubers of the resistant varieties (equipped with lenticels occupying a protected site in the skin, provided with suberin deposit and a dense array of complementary cells, and furnished with a relatively small aperture) transpired less freely than those of the susceptible ones in a given combination. Even in 12 comparative tests of two more or less resistant varieties, Ackersegen and Carnea, the former officially designated 'practically immune' and the latter 'somewhat susceptible', the more resistant showed a consistently slighter loss of weight than the semi-susceptible. Similarly, in 15 out of 16 tests (93·7 per cent.) with Robinia and Optima, the former transpired less vigorously and should thus be regarded as the more resistant, an opinion confirmed by field observations. An apparent exception is constituted, however, by the Carnea-Robinia combination, the latter being officially placed in a more resistant category than the former, whereas 7 out of 9 (77·8 per cent.) of the writer's measurements denoted the contrary: according to Schlumberger's latest results, however, Carnea is actually more resistant than hitherto assumed [ibid., xix, p. 564].

There would appear from the outcome of these experiments to be no doubt that intensity of transpiration affords a useful standard for the estimation of varietal reaction to *A. scabies*.

Locke (S. B.). **First report of bacterial ring rot in Arkansas.**—*Plant Dis. Reptr*, xxiv, 12, p. 234, 1940. [Mimeographed.]

Cook (H. T.). **First report of bacterial ring rot in Virginia.**—*Plant Dis. Reptr*, xxiv, 13, p. 252, 1940. [Mimeographed.]

These reports record the occurrence of potato ring rot (*Phytomonas sepedonica*) [*Bacterium sepedonicum*: *R.A.M.*, xix, pp. 428, 725] in Arkansas and Virginia, respectively.

Person (L. H.). **Some new or unusual occurrences of Potato diseases in Louisiana.**—*Plant Dis. Reptr*, xxiv, 13, pp. 252–253, 1940. [Mimeographed.]

Pink rot of potatoes (*Phytophthora erythroseptica*) [*R.A.M.*, xix, p. 235] was observed for the first time in Louisiana in May, 1940, on the Katahdin variety. *P. infestans* was found in the same year for the first time since 1928, the season being probably the most conducive to infection yet experienced. Bacterial ring rot (*Phytomonas sepedonica*) [*Bacterium sepedonicum*: see preceding abstract], first observed in 1939, in Rapides and Livingstone Parishes, was present in 1940 in the entire commercial potato-growing area of the State. The most severe infection, averaging 3 to 5 per cent., occurred on the Triumph variety in Lafourche Parish. The evidence indicated that the disease is not carried over in the soil locally. Bacterial brown rot (*Bact. solanacearum*) [ibid., xix, p. 235] was also observed for the first time.

Glöckner (G.). **Untersuchungen über die 'Sang'-Krankheit der Kartoffeln im Rheingau.** [Investigations on the 'scorch' disease of Potatoes in the Rhine Province.]—*Angew. Bot.*, xxii, 3, pp. 201–252, 11 figs., 2 graphs, 1940.

For some years past the output of the potato crop in the north of the Rhine province has suffered a diminution of varying extent, sometimes involving total loss, as a result of the so-called 'scorch' disease, the development of which regularly coincides with a period of several days of hot, dry weather following a lengthy wet spell. The trouble is most severe on southward-facing, open hillsides and on shallow soils with an admixture of grey slate detritus and a loose, very stony surface. Prominent features of the disorder include inward rolling of the uppermost leaves, progressively extending to the lower ones, yellowing of the entire plant, drooping of the flaccid petioles and shoots, and gradual dying-off of all the foliage, commencing at the outer tips of the pinnate leaves. Diseased plants produce only a few small, flaccid, shrivelled tubers. The microscopic examination, in the early stages of the disease, of a conspicuous sunken, putrescent lesion on the stem base, at or near soil-level, merely reveals a brown discoloration due to heat; this, however, causes the death of the upper cell layers and thereby affords ingress to secondary soil pathogens, e.g., *Verticillium albo-atrum* and probably *Fusarium* spp. and *Botrytis cinerea*, which penetrate the tissues in the form of a wedge, destroying the cell layers down to the xylem. Under conditions of protracted humidity the disorganized cortical layers frequently rupture at the site of injury, and the affected plants are liable to break or split at this point on lifting.

In field trials to determine the effect of various disinfectants, fertilizers, and soil amendments on the incidence of scorch, the susceptible Industrie, Parnassia, and Prisca varieties produced their maximum yields of 225, 208, and 118 kg. per acre, respectively, in plots treated with brassisan [*R.A.M.*, xix, pp. 130, 539] (45 gm. per sq. m.) or uspulun (10 gm.), the former being used for the two first-named and the latter for the third. Another very good soil disinfectant is brassicol [ibid., xix, p. 508] (30 gm. per sq. m.). The varieties Allerfrüheste Gelbe (also susceptible), Ackersegen, Flava, Havilla, Mittelfrühe, and Voran proved more responsive to the application of fertilizers, of which calcium cyanamide (300 kg. per ha.) was particularly beneficial and ammonium sulphate (same rate) also gave good results. In a comparative test on the resistant Ackersegen and Ostbote varieties of the following treatments: strewing the soil with superphosphate, the soil disinfectants $P_1$ and $P_2$ [ibid., xix, p. 564] (40 gm. per sq. m.), sprinkling the soil with 0·5 per cent. 1192a or 1 per cent. Bordeaux mixture, and spraying the foliage with the last-named (all at 20 l. per are), the increased yields in the former amounted to 33, 28, 44, 20, 16, and 14 per cent., respectively, over the untreated controls, and in the latter (omitting 1192a) to 16, 2, 38, 15, and 17 per cent., respectively. In addition to the above-mentioned susceptible varieties, Altgold and Konsuragis are also regularly affected by scorch and should be replaced locally by one of the more resistant types.

Even when a crop is totally destroyed by the disease, as in 1938, the field should not simply be abandoned without the minimum

precaution of burning all the debris to prevent the propagation of the secondary soil pathogens. Selected seed tends to suffer less than commercial from scorch, no tubers from fields affected by which should be used for planting.

Beeley (F.). **Annual Report. Pathological Division.**—*Rep. Rubb. Res. Inst. Malaya, 1939*, pp. 156–195, 1940.

In continued investigations by [R.P.N.] Napper on the control of root disease of *Hevea* rubber [*Ganoderma pseudoferreum*, *Fomes lignosus*, and *F. noxius: R.A.M.*, xix, p. 164] it was found that the two problems connected with young replanted areas, namely, (*a*) infections occurring within the boundaries of the old infected patches in the original stand and (*b*) infections occurring outside these boundaries, yield equally well to the standard treatment based on periodic tree-to-tree collar inspection, and need not, therefore, be dealt with separately. In areas where problem (*b*) is severe the treatment should be carefully applied to rubber trees, but it is not necessary to extend inspection to cover crops, except in areas with bush covers of a susceptible type (e.g., *Tephrosia* or *Crotalaria* spp.), where dead bushes should be removed. Collar inspection of bushes is uneconomic. It is particularly stressed that the most satisfactory method of treatment is to dig outwards from the collar of the tree towards the limit of spread of infection, and not towards the tree.

In further replanting experiments the fungal attack was shown to decline gradually after the second and in some cases after the first round of treatment. The incidence of infection on the rubber trees was 30 per cent. higher in areas with a creeping cover than in those with a bush cover. This difference was due to the increased incidence of *F. lignosus*, the total figures for *G. pseudoferreum* being approximately the same in the two types of area and those for *F. noxius* being too small to be significant. On the other hand, the bushes themselves suffer heavily from root disease; thus, in the creeping cover area the 303 infected points treated were all rubber trees, while in the bush cover area of the 824 points treated 230 were rubber trees and 594 bushes. The cost of treatment in the bush cover areas was consistently 50 per cent. higher than in the creeping cover areas.

Tabulated yearly results since the commencement of the replanting experiments [in 1937; loc. cit.] show the cost of six different treatments tested [namely, A, uniform digging to 18 in., both healthy and diseased roots being removed to this depth; B, digging to 10 in., otherwise as A; C, disease patches dug over to a depth sufficient to expose all infected roots, which are removed, and the remainder of the area dug uniformly to 10 in. without collecting the roots; D, disease patches treated as in C, but remainder of the area left undug, apparently healthy trees felled, by jack or grubber and the roots examined; E, no systematic digging, diseased trees dug out individually and infected roots removed, and healthy trees dealt with as in D; and F, no digging or removal of stumps, both healthy and diseased trees cut off at ground-level and the stumps poisoned by injection with sodium arsenite]. Method E, up to the end of the second year, proved to be the most economical treatment in the B.K.1 [inland] experiment. Treatment A

was the most expensive but B, C, and D are gradually catching up with it and F has already caught up with E. In the HI experiment [in a coastal area] a sharp decline in incidence of infection during the second year after planting resulted from treatments A, B, and C, although it continued to be high after C, while D, which is the standard treatment recommended by the Rubber Research Institute for use in both inland and coastal areas, resulted in a constant and low incidence of infection at a very low total cost.

Information obtained from an experimental clearing of virgin jungle for new plantation showed a reduced incidence of root disease during the early years after planting in areas cleared without burning, as compared with those burnt off in the usual way, twice as many infections occurring normally in burnt as in unburnt areas. No satisfactory explanation has yet been found for this fact.

The results of preliminary laboratory experiments carried out by K. P. John showed that on gallic acid medium the three main fungi involved in root disease have highly characteristic reactions.

F. Beeley records the occurrence of bark bursts on the stem and branches of budded rubber trees, appearing in form of small, longitudinal splits of which a dozen or more may be present over a foot of the stem of a four-year-old tree. Long streams of latex exude from these bursts and in time a vigorous callus is formed at the edges of the splits, which rapidly heal over without leaving serious after-effects. No parasitic organism could be detected and the disorder is believed to be entirely of physiological origin.

Mason (E. W.). **Presidential address on specimens, species and names.**—*Trans. Brit. mycol. Soc.*, xxiv, 2, pp. 115–126, 1940.

In the course of this presidential address to the British Mycological Society the author points the distinction between the specimen collected, the real or objective species, and the nomenclatural species to which they are referred. He asserts that the surest basis for the just diagnosis of specimens is the matching of good specimens of the species to be named against good specimens already correctly named, and makes the plea that the 'indoor' specimens derived from culture work should be reserved for other purposes than for naming 'outdoor' fungi.

Bisby (G. R.) & Mason (E. W.). **List of Pyrenomycetes recorded for Britain.**—*Trans. Brit. mycol. Soc.*, xxiv, 2, pp. 127–243, 1940.

This compilation (stated in a note on p. 126 by W. Brown, chairman of the Plant Pathology Committee, to be the first of a projected series of lists of groups of fungi recorded for the British Isles) is preceded by an introductory note briefly tracing the history of British Pyrenomycetes and explaining the authors' system of citation. The list comprises 1,423 entries and many doubtful and superfluous names are necessarily included. Only in the Xylariaceae, Hypocreaceae, and a few other groups are the records arranged to give a close approximation to the species present. The list is followed by two appendices, I Pyrenomycetes recorded from forays, and II Fungi exsiccati published in Britain, a list of 119 references, most of which were consulted in the preparation of the present list, and an index to genera and species.

Pinto (M. C. de R.). **IV Contribuïção para a flora criptogámica do norte de Portugal.** [Contribution IV to the cryptogamic flora of the north of Portugal.]—*Broteria*, ix, 3, pp. 113–128, 1940.

This further contribution to the cryptogamic flora of northern Portugal contains 60 Basidiomycetes in addition to 119 species of fungi first listed in *Bol. Soc. Geogr. Lisboa* in 1887–8. Among the Polyporaceae commonly associated with wood rots may be mentioned *Poria viticola* on vine trunks, *Fistulina hepatica* [*R.A.M.*, xix, p. 245] on cork oak, and *Stereum sanguinolentum* on the decorticated trunks of pine.

Gonçalves da Silva (S.). **Lista preliminar dos doenças das plantas do Estado do Espírito Santo.**] [A preliminary list of the plant diseases of the State of Espírito Santo.] Reprinted from *Bol. Minist. Agric. Rio de J., 1939*, 12 pp., 1940.

This is a list of the plant diseases observed in the State of Espírito Santo, Brazil, during 1937–8 [*R.A.M.*, xix, p. 520].

Park (M.), Paul (W. R. C.), & Fernando (M.). **Some studies on Tobacco diseases in Ceylon.—VI. The effect of priming and of the application of fungicides on the control of frog-eye in the field.**—*Trop. Agriculturist*, xcv, 1, pp. 8–15, 1940.

In further studies on the control of frog-eye of tobacco [*Cercospora nicotianae*: *R.A.M.*, xvii, p. 775; xix, p. 121], plots of Harrison's Special, primed and unprimed, were either sprayed with a proprietary colloidal copper fungicide [unspecified] containing 22 per cent. copper oxychloride plus a spreader (both as used in the previous experiments of this series), or dusted with a copper-lime dust containing a mixture of monohydrated copper sulphate and calcium hydroxide. The results showed that spraying was considerably superior to dusting, but the latter produced, nevertheless, a large and significant increase in yields over the control; thus, the yield of clean cured leaf was 402·4, 289·2, and 182·3 lb. per acre in sprayed, dusted, and untreated plots, respectively. Priming was shown to reduce the severity of the disease, the yields of the primed and unprimed plots being 343·7 and 238·9 lb. per acre, respectively. No estimate of costs of large-scale dusting was attempted, but it is suggested, on the basis of results obtained in previous studies, that a combination of a pre-optimum and a post-optimum dusting may provide more economic control of frog-eye than a single optimum spraying.

Valleau (W. D.) & Johnson (E. M.). **Tobacco diseases in Kentucky.**—*Plant Dis. Reptr*, xxiv, 12, pp. 236–238, 1940. [Mimeographed.]

During 1940, the epidemic of tobacco wildfire (*Phytomonas tabaci*) [*Bacterium tabacum*] and angular leaf spot (*P. angulata*) [*Bact. angulatum*: *R.A.M.*, xix, p. 678] that occurred in Kentucky between the south-central area of the state and the Ohio River was the most severe on record for this locality. Angular leaf spot was present almost everywhere, and wildfire was found in localities where it had never previously been observed. Of 223 beds treated with Bordeaux mixture none showed either disease, except for three plants where water washed across one bed, though of 466 untreated beds, 50 showed wildfire, 128 angular leaf spot, and 58 both diseases. Blue mould (*Peronospora tabacina*)

[ibid., xix, p. 733] was noted in 20 and 86 of the treated and untreated beds, respectively. Wildfire was more destructive than angular leaf spot, many plants affected with the former being killed or so dwarfed that they failed to set. The available evidence indicates that blue mould is unlikely to cause serious trouble in Kentucky except in those years when early and extensive infection develops in Georgia and the Carolinas. The only recommendation made at present is to use new bed sites every year, in places where they receive a maximum of sunlight.

GODFREY (G. H.). **Tomato curly top and other noteworthy plant diseases in the Lower Rio Grande Valley.**—*Plant Dis. Reptr*, xxiv, 13, pp. 255–256, 1940. [Mimeographed.]

During 1940, tomatoes growing in the Lower Rio Grande Valley, Texas, were affected for the first time (to any commercially important extent) by yellows or [beet] curly top [*R.A.M.*, xix, p. 440]. On 13th May, 15 per cent. of the plants in one section of a 150-acre tomato field lying to the north-west of Mission were found to be affected and entirely non-productive. A few individuals of *Eutettix tenella* were collected in the vicinity.

*Phymatotrichum omnivorum* [cf. ibid., xviii, p. 76] was present in portions of large carrot and root parsley fields near Mission; in irregular patches comprising about 50 per cent. of the area affected it was completely destructive.

SHAPOVALOV (M.) & LESLEY (J. M.). **Wilt resistance of the Riverside variety of Tomato to both Fusarium and Verticillium wilts.**—*Phytopathology*, xxx, 9, pp. 760–768, 1 fig., 1940.

This is an expanded account of the writers' experimental observations in California from 1930 to 1938 on the resistance of the Riverside tomato variety to *Fusarium* [*bulbigenum* var.] *lycopersici* and *Verticillium albo-atrum*, a preliminary note on which, covering the results up to 1937, has already been published [*R.A.M.*, xvii, p. 139]. The outcome of the 1938 tests confirmed that of previous trials, Riverside producing only 3·8 per cent. plants with infection of such severity as to destroy the stems and seriously reduce the yield, the corresponding figures for Marglobe, Stone, and the fairly resistant Pearson being 55·8, 64·1, and 6·2, respectively.

STANLEY (W. M.). **Purification of Tomato bushy stunt virus by differential centrifugation.**—*J. biol. Chem.*, cxxxv, 2, pp. 437–454, 2 figs., 1 graph, 1940.

At the Rockefeller Institute for Medical Research, purified preparations of the tomato bushy stunt virus [*R.A.M.*, xviii, pp. 143, 353] were obtained by differential centrifugation of the juices from frozen and unfrozen tomato, *Datura stramonium*, and *Solanum nodiflorum* plants infected by the disease. There was no indication of impairment in the activity of the virus, judged by the results of inoculations on half leaves of *Nicotiana glutinosa*, by freezing and thawing of the test material. The yield of virus from *D. stramonium* exceeded that from tomato or *S. nodiflorum* four or five times. Purified preparations were also obtained from the juices of tomato and *D. stramonium* by Bawden and Pirie's

chemical method. Although many of the properties of such preparations were apparently indistinguishable from those obtained by differential centrifugation, the specific virus activity of the chemically treated samples was definitely lower, evidently from the exposure to a temperature of 60° C. rather than as a result of precipitation with ammonium sulphate.

Nucleic acid of the ribose type was isolated from a preparation of bushy stunt purified by differential centrifugation. The virus appears to be a nucleoprotein containing about 17 per cent. nucleic acid, with an ultra-violet light absorption maximum at 2,650 Å, a sedimentation constant of $S20_w = 132 \times 10^{-13}$ (which is significantly lower than the value of $S20_w = 146 \times 10^{-13}$ reported by McFarlane and Kekwick [ibid., xviii, p. 143]), and a diffusion constant of $D20 = 1{\cdot}15 \times 10^{-7}$. Purified preparations, however obtained, assume the form of rhombic dodecahedric crystals with edges as great as 0·1 mm. Since the partially inactivated preparations obtained by the chemical method yield crystals similar to those of the fully active virus, crystallinity cannot be used as a criterion of purity in respect of virus activity.

Neurath (H.) & Cooper (G. R.). **The diffusion constant of Tomato bushy stunt virus.**—*J. biol. Chem.*, cxxxv, 2, pp. 455–462, 1940.

From the diffusion and the sedimentation constants of bushy stunt virus [see preceding abstract] a molecular weight of 10,600,000 [*R.A.M.*, xviii, p. 353] and a dissymmetry constant of $fD/f_0 = 1{\cdot}27$ were calculated. Assuming negligible hydration, this would correspond to a molecular axial ratio of 5·4 : 1 and 5·8 : 1 for prolate and oblate ellipsoids of revolution, respectively. About 77 per cent. hydration would have to be assumed in order to account for the value of the dissymmetry constant on the assumption of spherical shape.

Saiyananda (C.) & Celino (M. S.). **Leaf blight of Tomato.**—*Philipp. Agric.*, xxix, 4, pp. 365–377, 4 figs., 1940.

*Helminthosporium lycopersici* Roldan has been observed in recent (1939 to 1940) experimental studies at the Los Baños College of Agriculture, Laguna, Philippines, to attack tomato [*R.A.M.*, xvi, p. 209] plants at an early stage, inducing premature defoliation, failure to set fruit, and sometimes death, by the formation on the leaves of light to greyish-brown, coalescent, roughly circular lesions, on both surfaces of which are produced, singly or in clusters, simple, thick-walled, septate, erect or flexuous, light brown conidiophores, 45·9 to 105·4 by 5·1 to 6·8 (average 75·7 by 5·9) $\mu$, bearing at their tips light brown, fusoid to cylindrical, clavate to obclavate, continuous to 8-septate conidia, 20·4 to 78·2 by 5·1 to 11·9 (49·3 by 8·5) $\mu$. The cultural characters of the fungus on a number of standard media are described: on potato dextrose agar (the best) the colonies gradually turn from gull-grey through olive and dark olive-grey to mouse-grey, conidia being readily produced. Within the $P_H$ limits tested (3·8 to 8·4) the growth rate of the organism increased parallel with the steps in the transition from the acid to the alkaline side.

Inoculation experiments with *H. lycopersici* on tomato seedling leaves (by atomizing with spore suspensions or smearing with mycelium and

spores from potato dextrose agar) resulted in the development of typical blight symptoms, and the fungus was re-isolated from the infected tissues. Eggplant and pepper reacted to inoculation by mild foliar symptoms showing no tendency to spread. Wind and water are believed to constitute the natural means of dissemination in the field. The examination of stained inoculated leaf sections revealed the stomata as the usual channels of hyphal penetration, though occasional entry directly through the epidermis was observed. The conidia of *H. lycopersici* being able to retain their viability on tomato leaves for six months under dry conditions, the persistence of the disease from one season to the next is readily explained. Infection (both natural and artificial) was found to be much more severe on introduced American than on home-grown varieties, Marglobe, Dwarf Giant, Matchless, True Giant Ponderosa, and Sunnybrook Earliana all being destructively attacked in inoculation experiments, besides one native tomato. Control should be based on stringent field sanitation.

Kelsheimer (E. G.) & May (C.). **Verticillium wilt of Elm.**—*Plant Dis. Reptr*, xxiv, 14, pp. 282–284, 1940. [Mimeographed.]

Since 1933 a species of *Verticillium* [*R.A.M.*, xviii, pp. 67, 281] forming applanate to slightly pulvinate, greyish-green to black colonies and consistently producing pseudo-sclerotia has been isolated from American and English elms in 33 States of the American Union, extending from Oregon eastwards to Maine and from Minnesota southwards to Louisiana; *Ulmus fulva* may also be affected. Young trees are the most liable to infection, though older ones with a breast-high diameter of 48 in. are attacked too. The disease cannot be identified by symptoms alone. On 2 per cent. potato sucrose agar with a $P_H$ of 5·5 to 6·4 at 26° C. the fungus may develop in four days, though a period of 14 to 21 days is sometimes requisite.

Miller (P. W.), Bollen (W. B.), Simmons (J. E.), Gross (H. N.), & Barss (H. P.). **The pathogen of Filbert bacteriosis compared with Phytomonas juglandis, the cause of Walnut blight.**—*Phytopathology*, xxx, 9, pp. 713–733, 5 figs., 1940.

A comparative study was made of the morphological, cultural, biochemical, and pathological characters of a number of isolates of the filbert (*Corylus avellana* and *C. maxima*) blight pathogen prevalent in the Pacific North-West [*R.A.M.*, xix, p. 309] and various strains of *Phytomonas* [*Bacterium*] *juglandis*, the agent of walnut blight [ibid., xix, p. 373]. The two organisms showed no fundamental differences in morphological, biochemical or cultural characters, or staining reactions, while such variations as were observed in the assimilation rate of certain carbon sources could not be utilized for diagnostic purposes owing to their distribution among all the isolates of both pathogens. Similar but less marked variations in the rate of nitrogen consumption were also detected among the different isolates. On the other hand, the results of preliminary cross-agglutination tests on rabbits indicate the possibility of the serological separation of the two bacteria, while definite evidence of differences in pathogenicity was obtained in cross-inoculation tests in the field, all the walnut isolates being virtually innocuous to

filbert branches, and all the filbert strains non-injurious to walnut stems of current growth. On the basis of these pathological and serological differences the filbert pathogen is named *P. corylina* n.sp. The organism is a capsulate rod, 1·1 to 3·8 by 0·5 to 0·7 $\mu$, motile by one polar flagellum, Gram-negative, non-acid-fast, staining readily with gentian violet and carbol fuchsin; forming abundant, glistening, pale lemon- to coppery-yellow colonies on dextrose agar at 22° C.; slowly liquefying gelatine and peptonizing milk, hydrolysing starch, producing ammonia in peptone-containing broth, aerobic, not reducing nitrates to nitrites or forming gas, indol, or hydrogen sulphide; at 28° evolving acid from dextrose, levulose, galactose, lactose, sucrose, maltose, xylose, raffinose, mannitol, glycerol, and starch, and alkali from citrate, lactate, malate, and succinate, and utilizing (in order of availability) peptone, aspartic acid, alamine, leucine, sodium ammonium phosphate, allantoin, tyrosine, uric acid, and brucine; with a growth range from 5° or 7° to 37°, optimum 28° to 32°, thermal death point 53° to 55°, and a $P_H$ range from 5·2 to 10·5, optimum 6 to 8.

LUDBROOK (W. V.) & WHITE (N. H.). **Observations and experiments on Diplodia die-back of Pines at Canberra, A.C.T.**—*J. Coun. sci. industr. Res. Aust.*, xiii, 3, pp. 191–194, 1940.

Observations at Canberra during the past six seasons have shown the presence of *Diplodia pinea* [*R.A.M.*, xviii, p. 656] in association with die-back of pine trees. In one group of *Pinus ponderosa*, single shoots showed the condition each season, but the fungus generally failed to spread beyond the first or second node below the point of infection, and the general growth of the trees was not seriously affected. *D. pinea* possibly hastened the death of other trees within a mile of the Australian Forestry School exposed to drought but is not thought to have been the primary cause of their loss; while in a third locality the fungus may have functioned as an active pathogen. On 99 wound inoculations with *D. pinea* on 6 species of *Pinus*, 37 gave positive results, as also did 2 out of 15 inoculations on unwounded *P. radiata*. In all except 6 of the successful inoculations, the die-back appeared to be checked at the first or second internode below the inoculation site; the exceptions were all inoculations on weak lower laterals. These results indicate that under the conditions prevailing locally, *D. pinea* is not likely to cause serious injury to the hosts studied in the absence of factors predisposing to infection. *D. pinea* is ubiquitous as a saprophyte on debris in pine forests and is undoubtedly capable of actively parasitizing limited portions of vigorous trees, but such trees are normally able to resist its advance and confine the damage to insignificant proportions. One isolate of *D. pinea*, resembling *D. natalensis* [ibid., xvi, p. 219] in forming pycnidia more freely than normal in culture but differing in the absence of striations on the spores, was distinctly more pathogenic to lemons than the typical *D. pinea* and is regarded as a variant of that species.

LUDBROOK (W. V.). **Boron deficiency symptoms on Pine seedlings in water culture.**—*J. Coun. sci. industr. Res. Aust.*, xiii, 3, pp. 186–190, 1940.

Continuing his investigations into needle fusion in *Pinus* spp. in New South Wales [*R.A.M.*, xviii, p. 491], the author carried out experi-

ments [which are described] in which young *P. radiata* and *P. taeda* plants were grown in nutrient solutions with and without adequate supplies of boron [ibid., xix, p. 682]. Most of the plants lacking in boron showed a reduced growth rate, followed by cessation of apical growth, and the development of necrotic symptoms at the growing points of the tips and roots. The cessation of apical growth was accompanied by swelling of the stem apex, death of young needles adjacent to the apical bud, and resin exudation from the bud. The juvenile needles were shortened and bluish-green, while the mature needles were slow in appearing, few, and short. In some of the boron-deficient plants, the fasciculate needles showed a tendency to fusion.

These results are considered to demonstrate that boron is essential for the normal growth of the plants concerned in water culture, but it is not claimed that needle fusion symptoms, as they occur in pine plantations, are due to boron deficiency. It may be that 'fusion' of the needles is produced by more than one cause. Mycorrhizal development, dependent as it is on active root growth, may possibly be affected by boron deficiency in plantation soils.

BOWEN (P. R.). **Cenangium abietis, Brunchorstia destruens, and Crumenula abietina.**—*Proc. Pa Acad. Sci.*, xiv, pp. 95–99, 1940.

All the writer's attempts to induce fruiting in cultures of *Cenangium abietis* [*R.A.M.*, xviii, p. 490] and *Brunchorstia destruens* failed, and in crosses between the two species on various media the phenomenon of aversion was very noticeable. Inoculation experiments on *Pinus sylvestris*, *P. strobus*, and *P. resinosa* also gave negative results as regards spread and fruiting of the fungi. The apothecia of *Crumenula abietina*, received from Jørgensen on *P. sylvestris* twigs from Denmark, gave rise to a mycelium similar to that of *B. destruens* (of a definite green, composed of long, flocculent hyphae, the old mycelium in contact with the upper surface of the agar being massed into a blackish-green sclerotial layer). Inoculations into twigs of the three above-mentioned trees resulted in the development of pycnidia containing the typical conidia of *B. destruens*.

It is concluded from these observations that neither *Cenangium abietis* nor *B. destruens* (which are distinct species) is parasitic on young pines in the United States, and that *B. destruens* is the imperfect stage of *Crumenula abietina* [ibid., xii, p. 667].

MILBRATH (J. A.). **A Phytophthora disease of Chamaecyparis.**—Abs. in *Phytopathology*, xxx, 9, p. 788, 1940.

A destructive root and crown rot is stated to be causing heavy losses in ornamental plantings of *Chamaecyparis* [? in Oregon]. The death of the roots is followed by a uniform reddish-brown discoloration of the foliage. A sharp line of demarcation between the dead and living crown tissue may be observed beneath the outer layer of the bark at soil-level. An apparently new species of *Phytophthora*, for which C. M. Tucker suggests the name *P. lateralis* [without diagnosis], was isolated from a number of diseased trees and inoculated into healthy ones, resulting in their death after two to six months. The original organism was successfully reisolated.

Hopkins (J. C. F.). **Diseases of fruit, flowers, and vegetables in S. Rhodesia. 2. Black rot disease of Cabbages and Cauliflowers.**—*Rhod. agric. J.*, xxxvii, 9, pp. 508–511, 1 fig., 1940.

In Southern Rhodesia, cabbages and cauliflowers are commonly affected by black rot (*Bacterium campestre*) [*Pseudomonas campestris*: *R.A.M.*, xviii, pp. 234, 565] during the rainy season, while the disease has also been reported locally on turnips. During 1940, many cases of severe infection of cauliflowers were reported from all parts of the Colony in April, May, and June, the outbreak perhaps being induced by exceptionally heavy late rains. Even at the end of June, serious infection of cabbage seedlings was present, and many cauliflowers were found to be stunted. Control measures would appear to be required at all periods of the year. Much of the seed sold locally appears to carry the pathogen externally, and all seed should be disinfected by the hot water treatment [ibid., xix, p. 250] or the use of mercury compounds. Crop rotation is also necessary, and all plant debris from diseased crops should be destroyed. Where cabbages or cauliflowers are grown on a large scale the seed-beds should be sterilized by the open-fire method before sowing. The young plants should be sprayed three or four times with Bordeaux mixture (4–4–50) plus lead arsenate ($1\frac{1}{2}$ lb. per 50 gals.) and a good spreader. This practice has proved very beneficial locally.

Gonçalves [da] Silva (S.). **A ferrugem branca das cruciferas.** [White rust of crucifers.]—*Biologico*, vi, 8, pp. 225–226, 1940.

This is a popular note on white rust (*Albugo candida*) [*Cystopus candidus*] of crucifers, of which only radish [*R.A.M.*, xviii, pp. 228, 471] is affected to any appreciable extent in Brazil. Spraying with 1 per cent. Bordeaux mixture in the seed-bed and field is recommended in addition to routine sanitary measures.

Gaskill (J. O.) & Kreutzer (W. A.). **Verticillium wilt of the Sugar Beet.**—*Phytopathology*, xxx, 9, pp. 769–774, 3 figs., 1940.

A species of *Verticillium* with morphological and cultural characters closely resembling those of *V. albo-atrum* was isolated in August, 1939, from the necrotic vascular tissues of the tap-roots of sugar-beets in Colorado, where seven fields in three districts were affected with a maximum incidence of 1 per cent. The first external symptoms of infection were the wilting and dying of the outer foliage, following which the inner leaves developed a narrow, pointed habit, turning yellow and becoming slightly flaccid, with the petioles twisting away from their normal positions and the leaf blades showing a revolute curling of the margins. The diseased roots were only 7·9 per cent. lower in weight than the healthy controls, but there was a highly significant reduction of 27·5 per cent. in the sucrose content of the former.

Murphy (D. M.). **A Great Northern Bean resistant to curly-top and common Bean-mosaic viruses.**—*Phytopathology*, xxx, 9, pp. 779–784, 1 fig., 1940.

The Great Northern U.I. 15 hybrid bean [*Phaseolus vulgaris*], a selection from the Red Mexican material which has already provided

Idaho growers with the mosaic- and curly top-resistant U.I. 3 and U.I. 34 lines [*R.A.M.*, xvii, p. 646], has given highly satisfactory results in experimental plots from 1937 to 1939, inclusive, its average yield for the period under review being 26·7 lb. per 50 ft. of 4 rows, compared with 19·1, 20, and 17·9 for U.I. 123, 81, and 59, respectively, and its incidence of curly top nil as against 22, 21·6, and 29·6 per cent., respectively, for the three other test strains. The selection has further maintained a continuous freedom from mosaic.

DANA (B. F.). **Resistance and susceptibility to curly top in varieties of common Bean, Phaseolus vulgaris.**—Abs. in *Phytopathology*, xxx, 9, p. 786, 1940.

Extensive field trials are stated to have revealed extreme susceptibility to curly top among varieties of wax-pod snap beans (*Phaseolus vulgaris*), moderate to extreme susceptibility in green-pods, and reactions ranging from extreme susceptibility to strong resistance or immunity among field or dry beans, the only representatives of the last-named category being California Pink, California Red, Red Mexican, Burtner, and Jenkins or Idaho Cream. The disease is liable to kill seedlings of susceptible varieties, while older plants gradually turn yellow and die. In both seedlings and older plants the growing points are usually destroyed at an early stage and may fall away. Plants continuing to develop after infection are dwarfed, with shortened internodes and abnormally small, profusely curled leaves. Progeny selections in the $F_4$ of crosses between Blue Lake and Burtner and reciprocals manifested a high degree of resistance to curly top combined with excellent quality.

DUNDAS (B.). **A preliminary report on the inheritance of resistance to rust (Uromyces appendiculatus) in Beans (Phaseolus vulgaris).**—Abs. in *Phytopathology*, xxx, 9, p. 786, 1940.

The inheritance of resistance to four physiologic races of bean (*Phaseolus vulgaris*) rust (*Uromyces appendiculatus*), namely, Harter's 1 and 2 and two isolated from Florida and Washington material and tentatively identified by Harter as his strains 10 and 4 [*R.A.M.*, xix, p. 59], was studied by inoculating detached leaflets of plants from $F_2$ populations floated upside down on a 5 per cent. sucrose solution in Petri dishes. Tests on $F_2$ plants of the cross between Brown Kentucky Wonder 36928 (resistant) and Pinto (susceptible) indicated that the former carries three main independent dominant factors for resistance, A, B, and C, of which the first-named confers resistance to races 1, 2, or 10, the second to 1 and 2, and the third to 10. Similarly, observations on the progeny of the two resistant varieties, 36928 and Golden Gate Wax showed that the latter contains a single dominant factor for resistance to races 1, 4, and 10, differing from the three factors in 36928 and designated D. Further data indicate that other factors for resistance occur in other varieties.

DUNDAS (B.). **A new factor for resistance to powdery mildew (Erysiphe polygoni) in Beans (Phaseolus vulgaris).**—Abs. in *Phytopathology*, xxx, 1, p. 786, 1940.

A single dominant factor for resistance to powdery mildew (*Erysiphe*

*polygoni*), previously detected in Pinto and other field beans (*Phaseolus vulgaris*) [*R.A.M.*, xix, p. 60], has now been found to occur also in a strain of the Kentucky Wonder snap variety. A number of varieties contracting only slight infection in the field, but showing greater susceptibility in dish tests, do not contain the Pinto factor and may be classed as semi-resistant, their reaction varying from year to year and depending partly on the strains of the fungus present. Of 126 $F_2$ seedlings derived from a cross between the semi-resistant Long Roman and the susceptible Red Kidney, inoculated in the field with strain 1 [ibid., xii, p. 207] of *E. polygoni*, 94 manifested the Long Roman character for semi-resistance and 32 were susceptible, the 3 : 1 ratio indicating that the resistance in Long Roman is due to a main dominant factor. $F_3$ families from susceptible $F_2$ plants produced only susceptible populations. Of the $F_3$ families from semi-resistant $F_2$ plants, 29 were homozygous semi-resistant and 52 segregated in a ratio of 3 semi-resistant : 1 susceptible, thereby confirming the results of the $F_2$ tests.

KREUTZER (W. A.), DURRELL (L. W.), & BODINE (E. W.). **Pathogenicity and sexual phenomena exhibited by Phytophthora capsici.**—*J. Colo.-Wyo. Acad. Sci.*, ii, 6, p. 35, 1940. [Abs. in *Biol. Abstr.*, xiv, 7, p. 1208, 1940.]

*Phytophthora capsici* is stated to cause a blight of [chilli] pepper, a rot of tomato and cucumber fruits, and a wilt of squash and watermelon vines in the field in Colorado [*R.A.M.*, xix, pp. 254, 328]. The pairing of isolates from cucumber fruits with those from chilli stems in plates of nutrient media led to the linear formation of oospores at the junction of the colonies.

DU PLESSIS (S. J.). **Bacterial blight of Vines (vlamsiekte) in South Africa caused by Erwinia vitivora (Bacc.) Du P.**—*Sci. Bull. Dep. Agric. S. Afr.* 214, 105 pp., 14 pl., 1 fig., 1 graph, 1 map, 1940.

Bacterial blight of vines [*R.A.M.*, xviii, p. 498] was found to occur in 1936 in one region of the Worcester district of the Western Cape Province, South Africa, and was later observed in numerous vineyards of several other districts. There are indications that the blight had been originally introduced from overseas, probably not later than in 1926. Susceptible varieties like Sultana, Caanan, Henab Turki, and Red Hanepoot were so seriously affected by the disease that they totally failed to crop.

The disease is rarely observed in nurseries, although the stocks may carry internal infection. Symptoms usually appear five years after grafting and exhibit great variation, the chief being a pale, later black, discoloration of the lower two or three nodes extending upwards along the young shoots into the petioles and downwards into the stem and even some of the roots. Sometimes the discoloration is not continuous but broken into longitudinal areas. The underlying tissues disintegrate and the stem ultimately splits open. Cankerous lesions may develop, especially at the nodes. In heavily infected vineyards die-back of the shoots can frequently be observed, as well as the formation of a large number of adventitious buds which usually die off before they have had an opportunity of developing. Soon after the symptoms appear on the

shoots the leaves begin to turn yellow and subsequently bright brown, irregular discoloured portions being killed. Primary leaf spots are yellow at first, turning a bright reddish-brown later, up to about 7 mm. in diameter, irregularly or angularly circular, and glossy from a thin film of bacterial exudate. The stalks of the bunches in the pre-blossom period tend to be rigid, erect, thickened, and long, and bear fewer blossoms, which are small and often fail to be fertilized. More mature bunches become partly blackened and show small cankerous lesions, while the stalks are liable to drop with their crop. Berries affected in the earlier stages gradually wither and become mummified, mostly on the discoloured areas of the older parts of the exuded vines. A comparison of these symptoms with those described for 'mal nero', 'gommose bacillaire', 'gelivure', 'maladie d'Oléron', and others lead to the conclusion that all these diseases are similar to the South African blight.

A bacterium was isolated from affected material and its pathogenicity proved by inoculation experiments, although infection of the shoots was obtained only when they were severely injured and before lignification had advanced too far. It appeared that only leaves are liable to be infected in the uninjured state, the bacterium penetrating presumably through the stomata. Injuries conducive to infection are caused in vineyards by winds and through cultural practices. An examination of stained diseased tissue showed that the bacterium invades the young shoots from older infected main portions usually through the xylem, causing a browning of the walls and the formation of gum in these and neighbouring cells. Tyloses are frequently formed in the invaded xylem. The walls of the xylary ducts appeared to be extremely resistant to disintegration by the bacterium and yield only to subsequent fungal invasion. From the primary xylem of young shoots the organism passes into the xylem parenchyma, the cells of which become very enlarged and develop abnormally thin walls. The bacterium may further invade the cells of the medullary rays, which begin to collect gum and soon disintegrate. No gum has been observed in the cells of invaded cambium, which rapidly lose their shape and break up. In the phloem the organism attacks the phloem parenchyma, which may be either destroyed or the cells induced to enlarge abnormally before their ultimate destruction. The bacterium apparently thrives best in the tissues of the cortex and epidermis, where it also does the most damage; the cell walls collapse, and the intercellular cavities become filled with a dense mass of bacteria and sometimes gum. The disorganization and dislocation of the inner tissues due to hypertrophy is, however, not noticeable superficially, apparently owing to the rapid destruction of the cortical tissues. The bacterium further invades mature grape berries through the xylem and penetrates into the pulp cells. *Botryosphaeria vitis* was often found associated with the advanced stages of the disease, but is considered to be a secondary invader.

The causal bacterium is identified with *Bacillus vitivorus* Bacc. and is renamed *Erwinia vitivora* n. comb. It is described as short, rod-shaped, with rounded ends, 0·95 to 2·2 by 0·4 to 1·1 $\mu$ (average 1·5 by 0·7 $\mu$), occurring singly, in pairs, chains or packs, motile, with as many as eight perithrichous flagella, 20 $\mu$ long, capsulated, Gram-negative, non-acid fast, without involution forms, and facultatively anaerobic.

Young colonies on agar are punctiform or lenticular, ultimately circular, raised to pulvinate, and glistening; older cultures are light to orange-yellow, and smooth to rugose. Growth was most profuse on potato dextrose agar, fair on nutrient agar, and poor on synthetic agars. In liquid media the surface growth is flimsy, flocculent to granular, or rugose. The bacterium liquefies gelatine fairly slowly, causes milk to curdle with acid production, reduces nitrates, hydrolyses starch with the production of acid, produces hydrogen sulphide from peptone, apparently cleaves xylose, glucose, fructose, sucrose, lactose, mannitol, and salicin, with the production of acid, but cannot split raffinose or inulin. It grows best at $P_H$ 6·0 and fairly well at $P_H$ 7·7, but not at $P_H$ values below 4·2; its optimum temperature for growth is between 25° and 30° C., and it is unable to grow at 0° and 40°.

The different varieties of *Vitis vinifera* tested appeared to vary greatly in their susceptibility to the disease and are accordingly grouped in four groups, Almeria, Canon Hall, Malbec, Mataro, Muscat Hamburg, Pedro, and White Madeline being apparently resistant. The development of the disease appears to be favoured by excessive soil moisture and high contents of nitrogen and probably phosphates, and by high atmospheric humidity, especially when combined with high rainfall at temperatures between 20° and 25°. The organism is capable of overwintering mainly in the host tissues, being thus the primary source of infection of young shoots. It is disseminated by wind, water, and by contact through tools and the like. Experiments on the control of the disease during 1936 and 1937 failed to show any consistent positive results with any of the sprays or dusts tested, but the application of 10 per cent. copper sulphate solution in the autumn may be of some value on vines little affected by the disease. The general recommendations for control include the selection of sound material for scions and root stocks, periodical inspection of vineyards, pruning of infected vines immediately after leaf fall in the autumn, treating all wounds with a Bordeaux paste or coal tar after pruning, elimination or restriction of topping and trimming, spraying lightly affected vines with 10 per cent. copper sulphate in the autumn, uprooting of affected vines in vineyards where only a few vines have become infected, the destruction of all infected material, and the selection of resistant varieties and root-stocks.

Walters (D. V.) & Ludbrook (W. V.). **'Dying Vines' in the Murray Valley.**—*J. Coun. sci. industr. Res. Aust.*, xiii, 3, pp. 183–186, 1940.

For more than twenty years the irrigated vineyards of the Murray Valley have shown the presence of a condition known locally as 'dying vines', while the trouble has also been reported from the vicinity of Adelaide. Affected vines fail to make new growth in spring, and begin to die during the dormant period. Water-shoots may sprout from the base, but the new vine generally succumbs within a year or so. Occasionally, weak shoots develop in spring from the previous season's wood, but the foliage wilts towards the end of January before the fruit ripens, the vine subsequently dying. The losses incurred range from two to five vines per 20-acre holding each year, though on one occasion

30 vines died in one season in a 4-acre patch. In 1938, only about 100 affected vines were brought to the author's attention in 40,000 acres.

The dying vines appear to occur at random among healthy ones, but in some cases the evidence suggests that the condition is associated with waterlogging or salinity. Vines under eight years of age are generally unaffected.

Laboratory examination of affected vines showed, on splitting each vine longitudinally, a brown, hard, dry zone at or near ground-level, which appeared to have spread from mechanical injuries due to tillage. The affected wood had a characteristic sour odour, and 30 per cent. of 730 pieces when plated gave an unidentified imperfect fungus with scanty, yellowish-brown mycelium, and abundant straight, cylindrical, hyaline, 1- to 3-septate conidia. This fungus was obtained from 12 out of 14 vines examined.

Inoculations made with this fungus through wounds in the stems of 2- to 17-year-old vines in three localities resulted in discoloration of the wood of some of the vines; some of the controls showed a similar discoloration. As all the inoculated vines produced two seasons' healthy growth, it is concluded that the fungus is, at most, weakly pathogenic. The condition is probably physiological, though slow invasion of the wood through tillage injuries by weak parasites may be a contributory factor.

THOMPSON (A.). **Legislation in Malaya relating to trade in plants.**—*Malay. agric. J.*, xxviii, 9, pp. 408–413, 1940.

In this paper the author briefly summarizes the more important legislation in force at present in Malaya to control the import and export of plants [cf. *R.A.M.*, xvi, pp. 144, 848, *et passim*].

**Gold Coast. Regulations made under the Plant Pests and Diseases Ordinance.**—1 p., 1940.

The Plant Pests and Diseases (Swollen Shoot) Regulations, No. 44 of 1940, dated 16th July, 1940, prohibit the transport from the Eastern Province of any cacao plant or part thereof except dried fermented beans, unless under special permit from the Director of Agriculture [in order to prevent the spread of 'swollen shoot' *R.A.M.*, xvii, p. 224].

**No. F. 43–15/40–A. Government of India. Department of Education, Health and Lands. Notification (Agriculture).**—1 p., 1940.

Notification No. F 43–15/40–A., of 14th August, 1940, prescribes the following further amendment in the previous Notification No. F. 320/35–A of 20th July, 1936 [enforcing certification of citrus plants against *Deuterophoma tracheiphila*: *R.A.M.*, xvi, p. 496], viz., the insertion in paragraph 8, after the words 'British India', of the words 'except from Burma' [see next abstract].

**Burma Department of Agriculture and Forests. Agricultural Branch. Notifications Nos. 29 of 1937, 376 of 1939, and 75 of 1940.**—5 pp., 1940.

Notification No. 29 of 2nd November, 1937, superseding that of the

Department of Education, Health and Lands of the Government of India, No. F 320/35–A of 20th July, 1936 [*R.A.M.*, xvi, p. 496] makes the following provisions, *inter alia*, designed to prevent the introduction of plant diseases into Burma. No plant, except sugar-cane for planting in quarantine under the personal supervision of the Deputy-Director of Agriculture, East Central Circle, Pyinmana, shall be imported into the country by letter or sample post, the same exception being made to the restrictions on the importation of plants by air.

Only fruits and vegetables intended for consumption may be imported by sea without a duly authenticated certificate of freedom from pests and diseases. Potatoes imported by sea or air (except from India) must be accompanied by (1) a certificate from the consignor giving full particulars of the locality of cultivation and vouching for the absence therefrom of wart disease [*Synchytrium endobioticum*], and (2) an official certificate stating that, during the 12 months prior to the date of issue, no case of the disease has been recorded within five miles of the place of cultivation.

*Hevea* rubber plants destined for Burma must be officially pronounced free from infection by *Fomes semitostus* [*F. lignosus*], *Sphaerostilbe repens*, *Fusicladium macrosporium* [*Dothidella ulei*], and *Oidium heveae*. No rubber plants or seeds may be imported from America or the West Indies except by the Director of Agriculture.

Freedom from mal secco (*Deuterophoma tracheiphila*) is required in the case of lemon, lime, orange, grapefruit, or other citrus plants and cuttings.

The importation of sugar-cane by sea from Fiji, New Guinea, Australia, or the Philippines is prohibited absolutely: consignments from other countries must be accompanied by certificates stating that they are exempt from all forms of root rot, pineapple disease (*Thielaviopsis* [*Ceratostomella*] *paradoxa*), sereh disease, leaf scald [*Bacterium albilineans*], and gummosis [*Bact. vasculorum*], originated from a crop free from mosaic and streak, and that Fiji disease is absent from the country of export. Any plants grown in quarantine under the conditions referred to above, manifesting within the minimum statutory period of one year symptoms of a pest or disease not hitherto recorded in Burma, will be destroyed by fire.

Flax, Egyptian clover [*Trifolium alexandrinum*], and cotton seed may be imported only under a licence from the Director of Agriculture, and by sea. The importation of cotton seed is restricted to quantities not exceeding 1 cwt. for any one consignment for experimental purposes only, to enter exclusively through the port of Rangoon and to be subject on arrival to fumigation with carbon bisulphide. Unginned cotton may not be imported either by sea or air.

Coffee plants, seeds, and beans may also be imported solely for experimental purposes by the Director of Agriculture, except that roasted and ground coffee or consignments of unroasted or unground coffee beans or seeds produced in India may be imported if accompanied by a properly authenticated certificate.

The importation of *Sebastiana palmeri* and of gram [*Cicer arietinum*] is prohibited absolutely.

IMPERIAL MYCOLOGICAL INSTITUTE

# REVIEW

OF

# APPLIED MYCOLOGY

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SCHOENE (F.). **Combating the leaf spot disease.**—*Zbl. Zuckerindustr.*, xlviii, p. 20, p. 314, 1940. [German. Abs. in *Facts ab. Sugar*, xxxv, 9, p. 35, 1940.]

Beets were sprayed with a 1 per cent. solution of neu, a Bayer copper-lime product [*R.A.M.*, xviii, p. 649], on 8th July, 19th August, and 8th September, [? 1939], for the control of leaf spot (*Cercospora*) [*beticola*: ibid., xix, p. 688], the experiment being divided into three sections (1) controls, (2) only the upper sides of leaves sprayed, and (3) both sides treated. The following yields were obtained: (1) controls, 8th July, beets, leaves, and sugar, 344, 224, and 44·8 q. per ha., respectively; 19th August, 370, 228, and 57 q. per ha., respectively; 8th September, 352, 306, and 59·2 q. per ha., respectively; (2) upper sides sprayed, 8th July, beets, leaves, and sugar, 340, 313·6, and 46 q. per ha., respectively; 19th August, beets and leaves, 428 and 352 q. per ha., respectively (no third application); (3) both sides treated, 8th July, beets, leaves, and sugar, 370, 320, and 57 q. per ha., respectively; 19th August, 403, 344, and 57 q. per ha., respectively; 8th September, 390, 306, and 68·2 q. per ha., respectively.

While the generally beneficial effect of fungicidal treatment emerges clearly from these data, no definite advantage from spraying both leaf surfaces is demonstrated.

**Annual Reports of the Department of Agriculture for the year ending 30th June, 1939. Economic Botanist's Report.**—*New Guinea agric. Gaz.*, vi, 2, pp. 13–19, 1940.

In this report (by R. E. P. Dwyer) the author states that wilt of mature coco-nut palms on deltaic and estuarine deposits of the mainland of New Guinea, though associated with many fungi, such as *Thielaviopsis* [*Ceratostomella*] *paradoxa*, *Botryodiplodia*, and *Fusarium* spp., etc., is due primarily to adverse soil conditions [*R.A.M.*, xix, p. 531]. The study of soil profiles has yielded much information as to the suitability of different localities for coco-nut cultivation where chemical data are unobtainable. It has become apparent that detailed chemical and botanical research on the nutrition of coco-nut palms in relation to soil factors is essential.

In a case of true bud rot, *Phytophthora palmivora* [loc. cit.] was obtained almost in pure culture from the central tissue of the lower trunk. The disease developed in one property in a rainy area of flats

and foothills during an abnormally wet season, but only on heavy soil. As the fungus develops only in a very moist atmosphere, other properties are unlikely to become affected. *P. palmivora* is widespread in New Guinea, where numerous hosts besides coco-nut are present; apparently, therefore, it causes serious losses to coco-nuts only under special circumstances, probably not unless a virulent strain is present. Active steps are being taken to control the disease.

On one coffee plantation, improved sanitation has reduced the formerly destructive thread blight (*Corticium koleroga*), die-back (*Diplodia* sp.), and root rot [ibid., xvi, p. 657] to a minimum.

Infection of leaf tobacco by *Cercospora nicotianae* was sufficiently severe to reduce the value for native use.

**Report of the Low Temperature Research Laboratory, Capetown, 1938–1939.**—180 pp., 20 figs., 39 graphs, 1940.

In this report [cf. *R.A.M.*, xix, p. 286] J. E. van der Plank and G. F. van Wyk (pp. 43–47) describe the preparation of tablets for the release of sulphur dioxide in packages of stored table grapes [against *Botrytis cinerea*]. The tablets are prepared from dehydrated alum and anhydrous sodium bisulphite with the addition of a little spermaceti to control the absorption of water vapour and act as a granulating agent. Analytical data are presented on the release of the gas under various conditions.

J. M. Rattray (pp. 48–60) gives details of tests in which table grapes of four varieties were stored for 20 to 21 days at 34° F., other lots undergoing a further storage period of ten days at 50°, the following treatments being given: (*a*) control, bunches wrapped in ordinary sulphite tissue paper, (*b*) control, bunches in waxed crystalline paper, (*c*) one sodium bisulphite-alum tablet (containing 0·22 gm. sodium bisulphite) packed with each bunch, the bunches being wrapped in sulphite tissue paper, (*d*) two tablets with each bunch, sulphite tissue paper, (*e*) as (*c*), but waxed crystalline paper, (*f*) one tablet (0·12 gm. sodium bisulphite) with each bunch, using sulphite tissue paper, and (*g*) as (*f*), using waxed crystalline paper. The results obtained [details of which are tabulated] showed that when the bunches were wrapped in sulphite tissue paper *Botrytis* and other fungal wastage (chiefly *Penicillium* sp.) was much reduced by all three concentrations of sodium bisulphite, and no sound fruit of any variety was injured by the treatment, but when waxed crystalline paper was used, while wastage was also effectively reduced, bleaching by the sulphur dioxide was caused. With either type of wrapping, the treatment also greatly reduced infection at 'loose' necks, and retarded desiccation of the stems. Thus, to give a few representative figures, after 20 days at 34°, lot (*c*) averaged 0·39 per cent. *Botrytis* waste and 0·15 per cent. other fungal waste, 0·58 per cent. loose neck, and 56 per cent. with green stems, the corresponding percentages for lot (*d*) being 0·34, 0·04, 0·31, and 64, and for lot (*f*) 0·51, 0·1, 0·88, and 59·0, while for control (*a*) they were 0·51, 0·22, 1·47, and 40, respectively. The figures for lots (*g*) and (*e*), with crystalline paper, were, respectively, 0·14, 0·04, 0·06, 99 and 0·33, 0·01, 0·01, and 100, while for lot (*b*), control, crystalline paper, they were 1·8, 0·31, 1·5, and 99. After a further 10 days at 50°, the percentages

affected in lot (*c*) were 1·29, 0·47, 0·9, and 29, and in lot (*d*) 0·95, 0·21, 1·16, and 35, respectively, as compared with 3·27, 0·82, 2·3, and 25 for control lot (*a*). Chemical analysis showed that the highest amount of sulphur dioxide found in grapes packed with 0·12 and 0·22 gm. sodium bisulphite did not exceed 5 parts per million, an amount well within the tolerance limit of 350 p.p.m. allowed by the Ministry of Health.

E. Beyers (pp. 60–63) adduces evidence demonstrating that the process of girdling the fruit canes one month after flowering markedly reduced the susceptibility of Waltham Cross grape vines to fruit shedding, the advantage of the practice being clearly apparent when the fruit was exposed to unfavourable storage conditions. The same worker (pp. 64–66) also showed that irrigation of Waltham Cross grape vines in an area liable to drought reduced susceptibility to 'drop berry' and stalk desiccation in storage.

J. M. Rattray (pp. 66–70) describes experiments which showed that waxing Honeydew melons before storage failed to control fungal wastage [unspecified] at 35° F., and accelerated it at 45° and 65°. The process also resulted in pitting at 35° and 45° (though not at 65°), and retarded ripening. Wastage was not controlled, at the concentrations used, by various fungicides incorporated in wax emulsions, but copper sulphate-starch paste containing 5 per cent. copper sulphate gave some control of stem-end rot [cf. ibid., xvii, p. 154].

W. E. Isaac and W. W. Boyes (pp. 78–88) show that Granny Smith apples after three months' storage at 31°, 34°, and 37° and held for a week at 65° had, respectively, 28, 25, and only 4·8 per cent. superficial scald. After four months, incidence was much higher at 31° (68·8 per cent.) than at 34° (53·6) and higher at 34° than at 37° (22·4), this relationship being maintained throughout the seven months the experiment lasted. At 31° and 34° (but not at 37°) a marked rise in incidence occurred between the end of the third and fourth months. Three weeks' delay before storage had no significant or consistent effect on scald incidence. Oiled wrappers considerably reduced the number of scalded apples (as compared with ordinary wrappers) during six months' storage at 34° and 37°, but at 31° their effectiveness was much decreased after four months.

J. E. van der Plank and J. M. Rattray (p. 88) state that the addition of ortho-phenylphenol to cultures on potato dextrose agar at 65° inhibited the growth of *Alternaria citri*, *Colletotrichum gloeosporioides*, *Diplodia natalensis*, *Phomopsis* [*Diaporthe*] *citri*, and *Sclerotinia libertiana* [*S. sclerotiorum*] at 0·005 to 0·01 per cent., *Penicillium digitatum* at 0·002 to 0·003 per cent., *P. italicum* at 0·01 to 0·02 per cent., and *Trichoderma lignorum* [*T. viride*: ibid., xviii, p. 761] at 0·002 to 0·005 per cent. The specific difference between *P. digitatum* and *P. italicum* is noteworthy.

In further tests by J. E. van der Plank and J. M. Rattray (pp. 88–93) of the storage of citrus fruits in wrappers impregnated with ortho-phenylphenol, employing lower concentrations than those used in the earlier experiments [ibid., xix, pp. 288, 590], lemons from Mataffin picked at a silver to yellow stage and stored for 28 days at 40° and then for 14 days at 65° developed 1·3 per cent. mould (mostly *P. digitatum*) and 0·3 per cent. other rots [unspecified] when packed in wraps

containing 14·6 mg. of the chemical per sq. ft. of wrap, as against 3·1 per cent. mould and 0·2 per cent. other rots when the concentration was 8·7 mg., and 9·9 per cent. mould and 0·5 per cent. other rots for the controls. The higher concentration of the chemical resulted in 5·2 per cent. injury (1·6 per cent. moderate to severe) and the lower in 0·6 per cent. (0·1 per cent. moderate to severe). With a second consignment from Karino the higher concentration of chemical alone was used, and gave 0·8 per cent. mould and 0·6 per cent. other rots, as against 5·4 per cent. mould and 0·6 per cent. other rots for the controls, injury due to the chemical amounting to 16·6 per cent. (2·3 per cent. moderate to severe). In a third test, lemons from Groot Drakenstein were stored, wrapped and unwrapped, for 54 days at 60° in boxes lined with waxed crystalline paper. The resulting figures were, for the higher concentration of chemical, 0·2 per cent. mouldy or completely rotten fruits and 0·1 per cent. infection by *T. viride*, the corresponding figures for the lower concentration being 0·1 and 0·2 per cent., and for the controls, 2·3 and 5·8 per cent., respectively. The higher concentration caused 54·6 per cent. injury (3·1 per cent. moderate to severe), and the lower 2·2 per cent. (0·1 per cent. moderate to severe). *T. viride* spread vigorously by contact in the controls, but its progress was almost completely arrested by the impregnated wraps. The humid conditions in the box caused the buttons to become infected and unsightly and to tend to fall off, but the fruits in the impregnated wraps were unaffected, and at the conclusion of the experiment appeared as if newly picked. In further tests, injury due to the chemical was greatly reduced by the addition of glyceride oils to the wrappers.

The same authors (pp. 93–98) found that ortho-phenylphenol was considerably more injurious to the rind of oranges than equivalent concentrations of its sodium salt. Used as a disinfectant for oranges inoculated with *P. digitatum*, ortho-phenylphenol was more effective than equivalent concentrations of sodium ortho-phenylphenate, which was even less effective when alkali was added to prevent hydrolysis; in practice, however, the greater potency of the ortho-phenylphenol was more than offset by its stronger tendency to cause rind injury.

Work by J. E. van der Plank (pp. 98–103) showed that a suitable bleaching solution for the treatment of citrus fruits affected with sooty blotch [*Gloeodes pomigena*: ibid., xix, p. 401] may be made by mixing chloride of lime and sodium bicarbonate. Bleaching solutions prepared with sodium bicarbonate are considerably more reactive than eusol, which is borate-buffered at too low an acidity for the release of any considerable quantities of free hypochlorous acid. For commercial use a ratio of sodium bicarbonate to Tropical chloride of lime, supplied by I.C.I. (General Chemicals) Ltd., Widnes, Lancs., England, of about 0·75 is advised. As bleaching solutions so prepared are unstable, especially when the available chlorine is over 0·2 per cent., they must be used immediately. The bleaching time required (at 16° C.) for chloride of lime solutions containing 0·33 per cent. available chlorine ranged from three to five hours when no sodium bicarbonate was used ($P_H$ 11·8) to 35 seconds when the ratio sodium bicarbonate : chloride of lime was 2 ($P_H$ 7·45).

In further investigations by J. E. van der Plank, J. M. Rattray,

and P. A. Crous (pp. 110–112) on the storage of lemons temperatures as low as 40° F. slightly retarded decay; fruits from Groot Drakenstein stored at 40°, 50°, 55°, 60°, and 70° showed, after 27 days, 0·2, 1·2, 2·9, 1·4, and 4·2 per cent. waste due to mould (mainly *P. digitatum*) and other waste (chiefly *Colletotrichum* [*gloeosporioides*]). The advantage was, however, only transitory. On exposure to warm temperatures, fruit stored at 40° decayed at a slightly faster rate than that stored at higher temperatures. Maturity at picking greatly affected decay, the riper fruits being more susceptible. For instance, lemons from Mataffin picked in the green stage, after storage for 28 days at 40°, 45°, 50°, and 55° showed, respectively, 0·8, 0·3, 1·5, and 1·5 per cent. total waste, the corresponding figures after the further 14 days at 65° being 2·6, 1·4, 1·6, and 1·9 per cent. Fruits from the same locality picked in the silver to yellow stage and stored at 40° and 50° for 28 days showed 3·1 and 4 per cent. total waste, respectively, the corresponding figures after a further 14 days at 65° being 10·4 and 7·4 per cent.; with both stages of maturity, the mould was entirely *P. digitatum.* Lemons from Karino stored for 4 weeks at 50° showed 0·4 per cent. wastage for the greener stage and 2·2 per cent. for the riper. Lemons from Rustenburg picked in the green, intermediate, and ripe stages, and stored for four weeks at 50° showed, respectively, 0·1, 0·2, and 0·8 per cent. total wastage, stem-end rots being the chief cause of decay.

Lemons stored for 28 days at 40° to 70° in lined and unlined boxes averaged, respectively, 2·5 and 1·2 per cent. waste, mostly *P. digitatum.* In one lined box at 60° *S. sclerotiorum* spread by contact, and in another at 70°, *Botrytis* sp. was present, both fungi being rarely found on South African citrus fruits. Another consignment stored in lined and unlined boxes for 54 days at 60° showed 8·1 and 2·5 per cent. total waste, respectively. The increased waste in the lined boxes was due primarily to stem-end and lateral rotting caused mainly by *T. viride*, which spread vigorously by contact.

J. E. van der Plank and J. M. Rattray (pp. 124–125) show that in tests with stored Navel oranges from Rustenburg, the removal of fruits infected with *P. digitatum* did not affect the subsequent development of decay, this result indicating that infection did not progress by contact.

D'Oliveira (B.). **Aspectos actuais do problema das ferrugens.** [Present-day aspects of the rust problem.]—*Palestras agron.*, ii, 2, pp. 5–77, 6 pl., 2 figs., 3 diags., 5 graphs, 1940.

This is a comprehensive survey of the literature from 1890 to 1939 on various aspects of the problem of rust diseases in plants, most of the more recent papers cited in the 11-page bibliography having been noticed from time to time in this *Review.* Incidentally, the author touches on certain questions of special interest in Portugal. In the central and southern regions of the country, the aecidial stage of *Puccinia coronata* is formed on *Rhamnus alaternus*, which was readily infected with material taken from plants of the genera *Avena, Arrhenatherum, Lolium, Bromus*, and *Holcus*, showing the inconsistency of systems of classification of varieties based on host relationships. Portugal further appears to harbour some special forms having no connexion

with those described from other countries. For instance, aecidia of *P. graminis secalis* on *Anchusa officinalis* yielded races which were found to be specialized on wheat, *Bromus rigidus*, and rye. Aecidiospores from *A.* spp., collected in Serpa and Ferreira do Alentejo, infected wheat but not rye, while those of *A. officinalis* at Belém attacked wheat, rye, *Aegilops*, and *Bromus*. Uredospore pustules on wheat, rye, and *Aegilops* were produced by inoculum from *Anchusa* spp. in Odemira. *P. g. secalis* was also successfully inoculated into *Echium tuberculatum* and *E.* sp., not hitherto recorded as hosts of this rust, while *E. plantagineum*, *E. tuberculatum*, *E. pomponium*, *A. sempervirens*, and two species of *Cynoglossum* reacted positively to *P. triticina* from *Aegilops ovata*.

Discussing the various forms of resistance to rust [*R.A.M.*, xv, p. 635] in relation to breeding cereals in Portugal, the writer points out that, in the case of *P. graminis*, which appears during or after earing, the development of the morphological type should be attempted, whereas resistance to *P. glumarum*, *P. triticina* (in wheat), *P. anomala* (in barley), and *P. coronata* (in oats) should be based on protoplasmic characters, since the yellow rust frequently occurs too early in the season for morphological resistance to be complete, while the others produce their aecidia in the autumn, and the climate imposes no thermal limitations to their development during the earing period.

Newton (Margaret), Johnson (T.), & Peturson (B.). **Seedling reactions of Wheat varieties to stem rust and leaf rust and of Oat varieties to stem rust and crown rust.**—*Canad. J. Res.*, Sect. C, xviii, 10, pp. 489–506, 1940.

The reactions of various wheat varieties to 20 physiologic races of stem rust (*Puccinia graminis tritici*) [*R.A.M.*, xix, p. 647] and 8 of leaf rust (*P. triticina*), and of oat varieties to 11 races of stem rust (*P. graminis avenae*) [ibid., xix, p. 526] and 9 of crown rust (*P. coronata avenae*) [loc. cit.] were studied at Winnipeg, Manitoba. In the *vulgare* group, the varieties McMurachy, Eureka, and several strains received from Kenya [ibid., xix, p. 394] proved to be immune in the seedling stage from all races of stem rust used, when kept at ordinary greenhouse temperatures (varying from about 55° F. at night to 80° by day). This immunity, however, largely disappeared at constant temperatures of 75° to 80°. In the non-*vulgare* group, only Iumillo and Iumillo × Mindum showed immunity and when Iumillo was tested at 75° to 80° its immunity was occasionally modified to moderate resistance. Several other non-*vulgare* varieties, such as Pentad, Belaturka, Khapli, Black Persian, and *Triticum timopheevi*, were highly resistant to stem rust at ordinary greenhouse temperatures. Considerable resistance to leaf rust was shown by the wheat variety Illinois No. 1B.8 and certain derivatives of the crosses Warden × Hybrid English, Chinese × Progress, and Chinese × Emmer, which were also shown to maintain their resistance when subjected as adult plants to a rather severe artificially induced epidemic in the field. Moderate resistance was shown by Carina, Brevit, Webster, Hope, H.44, and various derivatives of the two last-named. None of the *vulgare* varieties tested was immune from,

or highly resistant to, both stem and leaf rusts, the most promising in this respect being *T. timopheevi* and Iumillo.

Four oat varieties derived from the cross Hajira × Joanette proved to be resistant or moderately so to all races of stem rust used, and certain strains derived from the crosses Hajira × Banner and Victoria × (Hajira × Banner Sel. 524) proved resistant to all but one of these races. The last-mentioned strains and the oat varieties Victoria and Trispernia were also resistant to all races of crown rust used.

These results are taken to show that there is no lack of available rust-resistant breeding material in either wheat or oats in Canada.

Klemm (M.). **Schadengebiete des Weizensteinbrandes (Tilletia tritici [Bjerk.] Winter) in Deutschland.** [Wheat bunt (*Tilletia tritici* [Bjerk.] Winter) zones of injury in Germany.]—*Forschungsdienst*, ix, 2, pp. 183–191, 1 graph, 9 maps, 1940.

A study of data supplied by the German plant protection stations and seed health reporters of the Statistical Office for the period from 1927 to 1938, inclusive, shows that, contrary to the general opinion, the incidence of wheat bunt (*Tilletia tritici*) [*T. caries*] among the winter varieties chiefly affected reaches a maximum in the regions adjoining the principal zones of cultivation of the crop and not in the latter themselves, with the exception of Württemberg. Generally speaking, the disease is most prevalent in localities where wheat is of relatively slight economic importance and the systematic seed-grain disinfection necessary to combat the fungus is either neglected or (as in Württemberg) difficult to practise on financial grounds, the bulk of the farms being of only moderate extent (5 to 20 ha.).

During the period under review 'bunt years' (i.e., those in which a tenth of the administrative zones of a given province reported heavy infection) recurred three times in north and central Germany (1933, 1934, and 1936) and four in the south (1927, 1930, 1936, and 1937), only one year, therefore, being common to both regions. Low soil temperatures at the period of germination of the seed [*R.A.M.*, xviii, p. 13 *et passim*], favour infection, a correlation frequently observed in the heavy soils and raw climates, e.g., of the Eifel Mountains and Württemberg.

Postponement of the sowing date as a means of preventing infection by *T. caries* can only be considered in the case of winter wheat, and then alone in districts where the frit fly [*Oscinis frit*] does not threaten such crops. The late sowing of summer varieties involves too heavy a yield reduction to be practicable.

Van der Walle (R.). **Les affections charbonneuses des céréales.** [Cereal smut diseases.]—*Chron. bot.*, vi, 2, pp. 33–34, 1940.

This is a concise survey of some important contributions (mostly recent work noticed at the time of publication in this *Review*) to the understanding of various aspects of the parasitism of the loose smuts of wheat and barley (*Ustilago nuda tritici* [*U. tritici*] and *U. nuda*), respectively.

Murphy (H. C.), Burnett (L. C.), Kingsolver (C. H.), Stanton (T. R.), & Coffman (F. A.). **Relation of crown-rust infection to yield, test weight, and lodging of Oats.**—*Phytopathology*, xxx, 10, pp. 808–819, 1 graph, 1940.

The coefficient of crown-rust (*Puccinia coronata*) infection (percentage of infection × type) showed a higher negative correlation with the yield and test weight of the 442 varieties and selections of oats studied in connexion with the 1938 epidemic at Ames and Kanawha, Iowa, than did either percentage or type of infection alone. The total correlations between coefficient of crown rust and yield were all highly significant, ranging from —0·75 to —0·80. For each unit increase in coefficient of crown-rust infection (in the presence of the effect of test weight, ripening date, height, and lodging), yield was decreased by an average of 0·21 to 0·32 bush. per acre, the corresponding figure for the crown-rust coefficient alone being 0·40 to 0·47 bush. per acre. Yield and test weight (lb. per bush.) were closely correlated in all the trials, each lb. increase in weight connoting an average yield increase of 0·47 to 2·39 bush. per acre. Lodging, height, and maturity date were all negatively correlated with yield, i.e., the stiffer-strawed, shorter, and earlier varieties tended to be more productive than the weaker-strawed, taller, and later ones.

Breeding for resistance to crown rust [*R.A.M.*, xviii, p. 242 *et passim*] is of the utmost importance under conditions such as those encountered in Iowa, where epidemics similar to that of 1938 were also reported in 1927 and 1935, and such varieties as Boone, Marion, and other new selections resistant to this disease, stem rust [*P. graminis*], and loose and covered smuts [*Ustilago avenae* and *U. kolleri*] are urgently required and should prove highly valuable.

Piper (C. S.). **Molybdenum as an essential element for plant growth.**—*J. Aust. Inst. agric. Sci.*, vi, 3, pp. 162–164, 1940.

The essential nature of molybdenum as a constituent in the growth requirements of oats was confirmed in 1939 in water culture experiments on the Algerian variety at the Waite Agricultural Research Institute, Adelaide [*R.A.M.*, xix, p. 727], traces of the element (0·02 or 0·1 mg. per l.) preventing the pale reddish-brown discoloration of the leaves affecting the controls, and increasing the grain and total yields.

Koehler (B.) & Dungan (G. H.). **Disease infection and field performance of bin- and hanger-dried seed Maize.**—*J. Amer. Soc. Agron.*, xxxii, 10, pp. 768–781, 3 figs., 1940.

One of the large-scale changes in the preparation of seed maize that took place when the production of hybrid seed developed as a specialized business was the use of hot-air drying bins instead of ear-hangers for drying the seed. This innovation has resulted in a considerable economy of space and labour, and investigations were conducted at the Illinois Agricultural Experiment Station to determine whether a corresponding improvement has occurred in the quality of the seed.

Bin-dried hybrid seed of the Commercial Hybrids A, B, C, and D, Illinois Hybrids 172, 384, and 582, and Griffith and Murdock Yellow

Dent varieties showed no superiority over material hanger-dried under appropriate conditions, as judged by field tests with fungicidally treated seed. In field trials with samples of maize from 22 seed-production fields dried in the two ways, the hanger-dried material averaged 3·2 bush. more per acre over a three-year period than that dried in bins, a statistically significant difference.

Ears of three commercial hybrids (Illinois 960, Nebraska 110, and U.S. 13) were hand-picked in seed-producing fields when the grain moisture was about 30 per cent., and divided at random into three lots of 120 each to determine the effect of different drying rates on internal seed infection and field performance. The ears were dried down to a 12 per cent. moisture content in controlled temperature and humidity tanks at three rates, viz., rapid (106° F., 32 per cent. relative humidity, requiring four days), moderate (70°, 65 per cent. relative humidity, one month), and slow (70°, 86 per cent. relative humidity, necessitating three months for reduction to 17 per cent. moisture). There was no appreciable difference in yield between the fast- and moderately fast-dried seed, but that dried slowly gave reduced stands and yields (2·9 to 11·6 bush. per acre less than the fast). This difference is attributed largely to infection by *Fusarium moniliforme* [*Gibberella fujikuroi*], *Penicillium* spp., *Nigrospora sphaerica* and *N. oryzae*, and *G. zeae* [*R.A.M.*, xvii, p. 519], the incidence of which in the rapid, moderate, and slow lots in 1937 and 1938 averaged 0·6, 5·1, and 33·1; 0·1, 0·2, and 15·6; 1·2, 4·6, and 8·3; and 0·0, 1·5, and 4·6 per cent., respectively. Decay was also caused by *Diplodia zeae*, *Cephalosporium acremonium*, and miscellaneous fungi. The total kernel infections of surface-sterilized seed (two-year averages) were 5·1, 18·3, and 69 per cent. for the rapid, moderate, and slow drying rates, respectively.

Field plots grown from nearly disease-free and *G. fujikuroi*-infected maize kernels from untreated ears dried in an identical manner showed some statistically significant reductions in yield from seed infection, averaging 1·8 bush. per acre over a three-year period.

THOMPSON (H. L.). **New treatment for chlorosis appears to be effective.**—*Citrus Leaves*, xix, 12, 13, 1939. [Abs. in *Chem. Abstr.*, xxxiv, 21, p. 7517, 1940.]

Lime-induced chlorosis of citrus [cf. *R.A.M.*, xvi, p. 313] has been corrected by drilling four holes in the soil surrounding the affected trees and filling each with about 3 lb. sulphur, which appears to produce local areas of acidity round the roots and thus neutralize the excess alkalinity. The latter is believed to render certain minor elements unavailable.

GUTMAN (G.). **The control of wastage by nitrogen trichloride ($NCl_3$).**—*Hadar*, xii, 4, pp. 111–112, 1939.

An account is given of the nitrogen trichloride process of citrus disinfection [*R.A.M.*, xvii, p. 444] against wastage in transit, mainly due to the green and blue moulds [*Penicillium digitatum* and *P. italicum*: ibid., xx, p. 13] and *Alternaria* [*citri*: ibid., xix, p. 699], which is stated to be now employed by the majority of Californian shippers. In experiments on a commercial scale in Tulare county in 1933–4 on Navel

oranges, untreated fruit showed 16·44 per cent. wastage after a month in storage, whereas in that exposed to nitrogen trichloride the wastage was only 3·41 per cent. In another test on fruit shipped to New York (an 11-day journey), the temperature in transit being 18·3° C. and the relative humidity 65 per cent., the amounts of wastage in the gas-treated and control lots were 1·2 and 8·5 per cent., respectively. Tests in 14 groves showed that fruit exposed to a concentration of 15 gm. gas per cu. ft. of air developed 1·06 per cent. wastage compared with 4·16 per cent. for the untreated controls.

Nitrogen trichloride, being 4·18 times heavier than air, is apt to affect breathing and sight, and is therefore passed through rubber hosing, while a tendency to explode above certain concentrations necessitates its admixture with air at a proportion of from 5 to 15 mg. per cu. ft. Fruits intended for long storage, for instance, lemons, are given three treatments, (1) when brought into the packing house in field boxes, (2) before packing, and (3) after loading into vans for transport to market. Most fruit is treated twice—before packing (three hours in special rooms with walls constructed of thin planks) and after loading, while in some cases only the last application is made. The gas penetrates the wrapping paper, so that this final treatment is designed to complete the sterilization process. The gas treatment in the vans, each of which usually contains 462 packed cases of fruit, lasts from five to eight hours, circulation being promoted by electric fans in the corners. In a special test by the California Fruit Growers' Exchange on fruit intentionally scratched with the nails in packing, the amount of wastage in the treated lots did not exceed 3 per cent. on arrival in New York, but the gas had been used at too high a concentration, causing the formation of brown rims round the bruises.

Van der Plank (J. E.), Van Wyk (G. F.), & Van Niekerk (O. T.). **Removal of sooty blotch from Citrus fruits.**—Reprinted from *Fmg S. Afr.*, xv, 170, pp. 201–202, 1940.

In this paper the authors describe a method of removing sooty blotch [*Gloeodes pomigena*] from citrus fruits by the use of a mixture of chloride of lime and sodium bicarbonate in the proportion of at least 10 to 12 oz. of the latter to 1 lb. of the former (Redheart Tropical brand) [see above, p. 52]. They point out that strong solutions are unstable, and bleaching plants adapted to the use of low concentrations are most economical in material. Strong mixtures for increasing the strength of solutions weakened through use may be made with the addition of soda ash, but ordinarily this substance is not desirable. The paper concludes with suggestions for avoiding waste and effecting economies in the chemicals used.

Rhoads (A. S.). **The cause and control of melanose.**—*Citrus Ind.*, xxi, 6, pp. 5, 9, 12, 5 figs., 1940.

A two- or three-day spell of cloudy, rainy weather is stated to provide optimum conditions for the infection of citrus fruits (among which grapefruit appears to be more susceptible than oranges) by *Diaporthe citri* in Florida, where control may be effected by the application, two to three weeks after the flowers have fallen, i.e., between 15th April

and 5th May, of 3–3–100 Bordeaux mixture plus 5 to 10 lb. wettable sulphur per 100 gals. In seasons when blooming is unduly prolonged or the spring is exceptionally wet, a subsequent treatment four weeks later may be advisable. Basic copper sulphate, copper ammonium silicate, and cuprous oxide are practically equal to Bordeaux in efficacy, and are moreover free from the undesirable tendency of the latter to increase the scale insect population of the sprayed surfaces, sometimes necessitating a supplementary spray, between 15th May and 15th July, of oil emulsion ($1\frac{1}{4}$ to $1\frac{2}{3}$ per cent. oil) or, in cases of milder infestation, 1 to $1\frac{1}{2}$ gals. lime-sulphur plus 5 to 10 lb. wettable sulphur per 100 gals. Two important secondary benefits accruing from the observance of the melanose control schedule are a reduction of up to 50 per cent. in the incidence of stem-end rot, and a mitigation in the severity of exanthema associated with copper deficiency [*R.A.M.*, xiv, p. 628].

BONDAR (G.). **Insetos nocivos e molestias do Coqueiro (Cocos nucifera) no Brasil.** [Noxious insects and diseases of the Coco-nut (*Cocos nucifera*) in Brazil.]—*Bol. Inst. centr. Fom. econ. Bahia* 8, 160 pp., 39 figs., 1940.

In part II of this manual on coco-nut pests and diseases in Brazil, the author gives notes (largely gleaned from foreign publications in the absence of relevant observations in the country itself) on *Fomes lamaoensis*, *Rhizoctonia bataticola* [*Macrophomina phaseoli*], *Thielaviopsis* [*Ceratostomella*] *paradoxa*, *Marasmius palmivorus*, *Phytophthora palmivora* (the effects of which on coco-nut are not usually serious under local conditions, though cacao pods are heavily damaged in the rainy season), *Pestalozzia palmarum*, and *Exosporium durum*, the two last-named being widespread in native plantings of *Cocos coronata* and *C. schizophylla*. *E. durum* may be the cause of appreciable damage, the diffuse spots on the leaves expanding into black crusts bearing the fructifications of the fungus, which sometimes attacks the opening leaflets, with resultant malformation of the midrib. When the peduncle and leaf rachis are invaded, prominent, elongated, pustular lesions develop and frequently exude an abundance of gum; the leaves become entirely blackened and cease to fulfil their vital functions in the metabolism of the plant, so that its health and productivity suffer.

HENDRICKX (F. L.). **Observations sur la maladie verruqueuse des fruits de Caféier.** [Observations on the warty disease of Coffee 'cherries'.] —*Publ. Inst. nat. Étude agron. Congo belge*, Sér. sci., 19, 12 pp., 1 fig., 1939. [Received November, 1940.]

The author's studies on the symptomatology and morphology of the strain of *Botrytis cinerea* responsible for the warty disease of coffee 'cherries' [*R.A.M.*, xv, p. 704], observed for the first time in the Belgian Congo (Ngweshe district) in May, 1938, are described. The infected cherries turn brown prematurely, shrink, and become mummified, while the surface is covered with minute, greyish-white pustules, bearing conidiophores. The fungus appears to be incapable of extending its growth beyond the pedicel, and the shrivelled cherries remain attached to the bushes. The berry is generally either absent or

converted into an amorphous, black mass; if formed at all, as in certain cases of early infection, it is spotted and furnishes only a low-grade product. Thus, the damage from this source, though limited, is by no means negligible, especially as the shrivelled cherries afford shelter to the numerous insects infesting dried coffee and permit them to complete their life-cycles.

The fungus was isolated in pure culture and inoculated into wounded and unwounded cherries at different stages of growth with positive results, reisolation being effected in all cases. Infection was shown by these experiments to take place while the cherry is in process of development but has not yet attained full maturity. The pathogen differs from other *B.* spp. primarily in its longer and wider conidia, measuring 12·7 to 18·2 by 8·2 to 10·9, average 15·1 by 9·7 $\mu$ on naturally infected fruits, 8·2 to 14·3 by 6·1 to 8·2 (12·2 by 7·7) $\mu$ in culture, and 10·9 to 14·5 by 7·3 to 9·1 (12·7 by 7·9) $\mu$ on artificially infected fruits; these dimensions approximate fairly closely to those of *B. paeoniae* [ibid., vi, p. 668], the characteristic apical swellings of the conidiophores of which are, however, absent from those of the coffee pathogen. The conidia of the latter, moreover, are distinctly longer and wider than those of *B. cinerea* f. *lini* (11 by 7 $\mu$) [ibid., xii, p. 372], narrower than those of *B. narcissicola* (13·2 by 9·5 $\mu$) [ibid., vi, p. 510; xvii, p. 42], and smaller than those of a number of other allied species. The coffee strain is accordingly designated *B. cinerea* f. *coffeae* n.f. [with a Latin diagnosis], close to *B. cinerea* f. *lini*.

LEHMAN (S. G.). **Cotton seed dusting in relation to control of seedling infection by Rhizoctonia in the soil.**—*Phytopathology*, xxx, 10, pp. 847–853, 1940.

Cotton seed dusted with new improved ceresan (1½ or 3 oz. per bush.) was planted in steamed sandy loam plus river sand inoculated with *Rhizoctonia* [*Corticium*] *solani* [*R.A.M.*, xix, p. 147; xx, p. 14] in a greenhouse (maximum day temperature in the first two tests in March 80° to 85° F., and in the last two in June and August 95° to 100°) [? in North Carolina], an untreated lot serving as a control, while another series of dusted and non-dusted seed was run in uninoculated soil.

The dusted seed showed significantly greater improvement in seedling emergence on inoculated than on uninoculated soil when the seeds were planted soon after adding the fungus to the soil, the calculated F value for interaction between seed treatment and soil inoculation in two experiments being 47·9 and 96·8, which far exceeds the 8·02 required for high significance. Only insignificant differences in seedling emergence from dusted and non-dusted seed were observed, however, when several weeks were allowed to elapse between inoculation and planting. The numbers of seedlings (*a*) living after emergence and (*b*) escaping stem infections were increased by seed treatment in all the trials, but the increase was not relatively greater by a statistically significant amount on inoculated than on uninoculated soil.

It is concluded from these results that the application of organic mercury dust to cotton seed before planting exerts little or no protective action against *C. solani* in the soil, in contrast to its unquestionable efficacy against seed-borne organisms.

Miller (J. H.). **The genus Myriangium in North America.**—*Mycologia*, xxxii, 5, pp. 587–600, 1940.

Plectomycetous fungi comprising the genus *Myriangium* [*R.A.M.*, xvii, p. 627], found on the bark of woody plants covering dead scale insects, occur over the whole world, but are particularly common in the southern parts of the United States. In this paper the author gives a succinct historical résumé of the literature of the subject, together with a systematic account of the genus, and describes (with a key) the species found in North America, viz., *M. duriaei* [loc. cit.], *M. asterinosporum* (Ellis & Ev.) comb. nov., *M. tuberculans*, and *M. floridanum*.

Howell (A.). **Studies on Histoplasma capsulatum and similar form-species. II. Effect of temperature.**—*Mycologia*, xxxii, 5, pp. 671–680, 3 figs., 1 graph, 1940.

Continuing his earlier investigations [*R.A.M.*, xviii, p. 456], the author found that the optimum growth temperatures for *Histoplasma capsulatum* [ibid., xix, p. 706], *Sepedonium chrysospermum*, *S. xylogenum*, and *Stephanoma tetracoccum* were, respectively, 25°, 20°, 25°, and 20° C. When *Sepedonium chrysospermum* was grown on potato maltose agar, sporulation was greatest at 25°, and not at temperatures at which radial growth reached a maximum. With *Stephanoma tetracoccum*, *H. capsulatum*, and *Sepedonium xylogenum* sporulation was directly correlated from the first with abundance of mycelium. Attempts to restore the tolerance of *H. capsulatum* to body temperature (37·5°) were only partly successful.

Vadalà (A. J.). **Mycotic infection of the broncho-pulmonary tract.**—*Ann. Otol., etc., St. Louis*, xlix, 2, pp. 291–358, 34 figs., 1940.

From an intensive study of the relevant literature, combined with personal observations at Ancon, Panama Canal Zone, the writer concludes that mycotic disease of the respiratory tract can be definitely diagnosed by bronchoscopic examination and study [*R.A.M.*, xx, p. 15], though diagnosis is stated to be immensely assisted by proper X-ray interpretation, supplemented by differential cultural studies.

The second part of the paper consists of detailed reports of 11 cases of broncho-pulmonary mycosis, in several of which *Torula histolytica* [*Debaryomyces neoformans*: ibid., xix, pp. 150, 536] and in one a member of the *Aspergillus fumigatus* group were implicated.

Swartz (J. H.) & Conant (N. F.). **Extensive lichenified eruption caused by Trichophyton rubrum.**—*Arch. Derm. Syph., Chicago*, xlii, 4, pp. 614–624, 6 figs., 1940.

Four cases of severe dermatophytosis causing an extensive lichenified eruption are reported, two (both on women at the Massachusetts General Hospital) being described in detail. Cultural and morphological studies of the pathogen on Sabouraud's dextrose agar established its identity with *Trichophyton rubrum*, characteristic features of which included an abundance of unicellular, subspherical microconidia, produced laterally along the slender hyphae and in clusters on the side branches, and elongated, clavate, multicellular, thin-walled macroconidia borne at the expanded ends of the hyphae. A list is given of

27 other species producing a red to purplish pigmentation in culture, the relegation of which to synonymy with *T. rubrum* [ibid., xiii, p. 303; xviii, p. 678] is proposed.

Moore (M.) & Conrad (A. H.). **Microsporosis of the scalp caused by Microsporum fulvum: report of a case and description of the fungus.**—*Arch. Derm. Syph., Chicago*, xlii, 4, pp. 610–612, 3 figs., 1940.

On Sabouraud's dextrose agar, *Microsporon fulvum* [*R.A.M.*, xix, p. 279], isolated from a circular patch of dermatitis on the scalp of a four-year-old boy at St. Louis, Missouri, forms in 16 days a white central umbo, surrounded by a powdery, ochraceous- or pinkish-buff to pale cinnamon-coloured, velvety down, which may in turn be encircled by an irregular, white, cottony growth (incipient pleomorphism). Concentric zones develop on maltose agar. The colonies consist of a large number of four- to six-celled, ellipsoid, thin-walled, verrucose fuseaux (macroconidia or closterospores), 30 to 55 by 10 to 15 $\mu$, produced in groups of 12 to 15 on branched conidiophores, and of spherical or ovoid microconidia or aleuriospores, 3 to 5 by 2 to 4 $\mu$, sessile or borne on short sterigmata. On sugar media chlamydospores, arthrospores, nodular bodies, pectinate hyphae, and spirals also develop.

The interest of this case centres largely in the rarity of the parasite in the United States, especially in the Mid-West.

McKay (R.). **Heat canker of Flax.**—*J. Dep. Agric. Éire*, xxxvii, 2, pp. 383–386, 2 figs., 1940.

In June, 1939, samples of flax suffering from a disease apparently identical with heat canker [*R.A.M.*, vi, p. 402; viii, p. 371; xix, p. 707], not previously reported from Ireland, were received from three separate farms on peaty soil in Co. Donegal. The most characteristic feature of the affected plants was the more or less sharply defined constriction of the stems at soil-level, just above which there was a tendency to swelling of the stem and the production of adventitious buds. The plants were 3 to 5 in. in height and the roots were thin and thread-like as a result of starvation, due to the inhibition of the downward flow of manufactured food materials from the top of the plant through the dead, shrunken cells of the cortex at the site of constriction, where *Corticium solani* was present as a secondary invader in a minority of cases (less than 10 per cent.), darkening the tissues and imparting a resemblance to damping-off.

Constriction of the stems at soil-level is mentioned by Pethybridge *et al.* (*J. Dep. Agric. Ire.*, xx, p. 327, 1920) as one of the phases of seedling blight (*Colletotrichum lini*), but in cases of fungal infection the dark stem lesions with water-soaked margins are usually accompanied by discoloration of the foliage and bear the minute, black setae of the pathogen, and the stem is of about the same diameter above as below the point of constriction. Spores of the fungus develop profusely after a few hours' incubation of the diseased stems in a moist chamber. It is evident, therefore, that heat canker is entirely unconnected with seedling blight.

The exceptionally hot weather prevailing towards the end of May

and in early June, 1939, is thought to have favoured the outbreak of heat canker, for which a high soil temperature—54° C. according to Reddy and Brentzel [*R.A.M.*, ii, p. 314]—is required.

LONGRÉE (KARLA). **Chalaropsis thielavioides, cause of 'black mold' of Rose grafts.**—*Phytopathology*, xxx, 10, pp. 793–807, 5 figs., 4 graphs, 1940.

Rose-growers in the eastern States of the American Union and near Chicago were confronted in 1938–9, and probably earlier, by an unfamiliar disease of home-grown *Rosa manetti* grafts released from a small area in northern Oregon. The cut surfaces were covered with the hyaline, later greenish, septate mycelium, similarly coloured endoconidia, and fuscous macroconidia of *Chalaropsis thielavioides*, the last-named organs imparting the typical aspect of 'black mould' [*R.A.M.*, xix, p. 409]. The pathogen may invade the cortex, the lumen of the vessels, the medullary rays, and the small parenchyma cells of the pith, both stocks and scions being affected. Infection prevents the formation of callus and the 'taking' of grafts, thereby causing the death of the scions involved. The fungus was also isolated from Chinese elm [*Ulmus campestris* var. *chinensis*] roots.

Inoculation experiments were carried out by various methods. In one series, the cut surfaces of *R. manetti*, *R. multiflora*, and Ragged Robin stocks, and of Queen Mary and White Killarney scions were dipped before grafting in a conidial suspension of a culture of the fungus from *R. manetti*; in another, a suspension was introduced into cut stems, and in a third, into cut ends, positive results being obtained in all cases, whereas no infection developed on unwounded stems sprayed with inoculum and kept moist for three weeks.

The general morphological characters of the rose pathogen conform to Peyronel's description (*Staz. sper. agr. ital.*, xlix, pp. 583–596, 1914), the width of the mycelium ranging from 2·2 to 5·4 $\mu$, the average length of the hyaline to olive-green endoconidia from rose stems ranging from 11·2 to 14·9 and their width from 3·7 to 5·6 $\mu$, the same from elm roots 14·1 to 15·3 and 3·4 to 4·3 $\mu$, respectively, the hyaline to olive-green or fuscous macroconidia from rose 13·4 to 13·5 and 11·3 to 11·5 $\mu$, respectively, and the same from elm 13·9 to 14·9 and 12·2 to 13·5 $\mu$, respectively [ibid., xiv, p. 801]. The maximum germinability of the endoconidia (95 per cent. at 18° to 21° C.) occurred in two-day-old cultures, whereas the macroconidia took from three to five months to reach a corresponding stage of maturity, the maximum germination of about 25 per cent. taking place at 12°. Both endo- and macroconidia frequently germinated directly into endoconidiophores from which fresh crops of endoconidia were produced. The minimum, optimum, and maximum temperatures for the growth of *C. thielavioides* from rose on potato dextrose agar were found to lie between 0° and 3·5°, 18° and 27·5°, and 30·5° and 33°, respectively. The temperature relations of the elm strain of the fungus were very similar, but the growth rate in this case was much more rapid. The rose isolate was able to grow (only superficially) and fruit on unsterilized pieces of Chinese elm, walnut, poplar, and peach wood, as well as on raw potato tuber and carrot, while the elm strain made a certain amount of growth on rose

stems. The rose strain (and to a lesser degree the elm isolate) exuded a characteristic sweet, fruity odour resembling that of isobutyl acetate when growing freely in culture or fruiting on rose tissue in moist chambers.

COOPER (K. W.). **Relations of Pediculopsis graminum and Fusarium poae to central bud rot of Carnations.**—*Phytopathology*, xxx, 10, pp. 853–859, 1940.

The name 'central bud rot' is proposed for the disease of carnations caused by *Fusarium poae* [*R.A.M.*, xix, p. 153] in place of the no longer applicable '*Sporotrichum* bud rot'. Young infected buds may appear outwardly normal, but on opening reveal a moist, brownish decay of the inner floral organs. The pistils, stamens, styles, and petal bases are sometimes completely rotted by the fungus. Embedded in the mass of disintegrated tissue and white, cottony fungal growth are the glistening, white, ellipsoid bodies of pregnant mites of *Pediculopsis graminum*, up to 3 mm. in length. Severely infected young buds usually fail to open, but medium-sized and large ones may do so, the open flower in such cases presenting a peculiar lop-sided appearance due to unilateral unfolding. The internal symptoms of the larger buds are similar to those observed in young tissues, accompanied by an external basal softening. White varieties are the most susceptible to central bud rot, which has been recorded from Nebraska, New York, Illinois, and New Jersey, as well as from Germany and New South Wales.

Positive results were given by the inoculation with cultures of *F. poae* from common grasses at Princeton, New Jersey, of slightly lacerated buds of an unnamed yellow, pink-flecked variety. Of these, 40 out of 50 became infected and all but one showed visible symptoms of the rot after an incubation period of a week and upwards at 12° to 16° C. The size of the buds at the time of inoculation exerted little effect on the course of the disease, which also caused no retardation of calyx growth, except in the smallest of those used in the experiments, for a period of at least 16 days. Buds exceeding 20 by 10·5 mm. nearly always tended to open by the close of the trials, notwithstanding extensive central decay. The dissection of two diseased buds of a pink variety on an adjacent bench revealed the presence of *F. poae*, which apparently could only have been transmitted by thrips present in the buds; in this connexion Wollenweber and Reinking's observation of the association between *Anaphothrips* and the fungus is of interest [ibid., xv, p. 321]. More than half of a number of strains of *F. poae* weakened by three years in culture without re-passage through normal hosts regained their former vigour and capacity for staining the medium an intense violet-red after a brief occupation of carnation buds, but the recovery was only temporary. Of 119 buds on plants of four different-coloured carnations exposed to soil infestation by hundreds of actively wandering *P. graminum* released from infected tube cultures of *F. poae* growing on potato dextrose agar, 24 (20 per cent.) developed bud rot, the highest incidence (12 out of 28) occurring in a pink-flecked white variety. It is considered evident from these data that the mite acts as a vector of the pathogen, the gnawing of the tender tissues by the nymphs apparently inflicting the wounds necessary for its ingress.

The pregnant mites are believed to obtain their nourishment exclusively from diseased buds.

The conclusion of Molz and Morgenthaler (*Ber. dtsch. bot. Ges.*, xxx, pp. 654–662, 1912) that central bud rot was introduced into Germany on North American carnations would seem to be invalidated by the observations of Korff (*Prakt. Bl. Pflanzenb.*, iii, pp. 109–113, 122–126, 1905) and others on the prevalence of *P. graminum* in connexion with 'white ears' of Gramineae in German meadows and grain fields.

CELINO (M. S.). **Experimental transmission of the mosaic of Abacá, or Manila Hemp plant (Musa textilis Née).**—*Philipp. Agric.*, xxix, 5, pp. 379–403, 5 pl., 1940.

Abacá (*Musa textilis*) mosaic (*Cucumis* virus 1 or *Marmor cucumeris*), which is assuming an increasingly destructive character in Davao, Philippines [*R.A.M.*, xviii, p. 801], was experimentally shown to be readily communicable from diseased to healthy plants by *Rhopalosiphum nympheae* and *Aphis gossypii*, which were unable, however, to transmit bunchy top of the same host [ibid., xviii, p. 444], probably owing to the specific relationship prevailing between the latter virus and *Pentalonia nigronervosa*. The mosaic virus, which is regarded as identical with that of Magee's infectious chlorosis of banana [ibid., xix, p. 481], proved to be non-transferable to healthy plants by *R. nigronervosa*, *Ferrisia* [*Ferrisiana*] *virgata*, and *Stephanitis typicus*, by needle pricks, or by sap injection.

The first perceptible symptom of mosaic, appearing eight to ten days after the feeding of viruliferous aphids on healthy plants, consists of small, yellowish-white dots on the newly unfurled leaves, elongating into short, narrow dashes but retaining their original central dots; the later developing foliage shows typical mottling, which also occurs in an advanced stage of infection on the petioles and pseudostems of succeeding leaves. Eight adults of *R. nympheae* suffice to inoculate an abacá seedling with an effective dose of the virus, which is not transmitted from adults to their progeny. The aphids require a period of two hours' feeding on diseased plants to obtain the virus, which is all lost again in the first feeding on a healthy abacá.

The abacá mosaic virus was experimentally transmitted to *Canna indica*, but not to *C. edulis* or other *C.* spp., cotton, or camia (*Hedychium coronarium*), while attempts to convey it to a number of banana varieties also failed, possibly because the aphids were unable to gain a foothold on the plants. *R. nympheae* and *A. gossypii* penetrate the young abacá foliage either through the stomata or directly by way of the lower epidermis, their stylets passing between and occasionally through the cells to reach the phloem.

The measures recommended for the exclusion and eradication of bunchy top from abacá plantations [ibid., xi, p. 46; xiii, p. 444] are likewise applicable to mosaic.

LASKARIS (T.). **Report of the Delphinium crown rot investigation fellowship.**—*Delphinium, 1939*, pp. 102–108, 5 figs., 1939. [Abs. in *Exp. Sta. Rec.*, lxxxiii, 3, p. 359, 1940.]

Studies in progress are reported to have shown that the fungus

responsible for a serious new crown and root rot of larkspur is a hitherto undescribed species of *Diplodina*, which is also capable of causing foliar blight, local stem necrosis, and canker. A brief survey is given of other organisms producing similar diseases of the same host [cf. *R.A.M.*, xix, p. 475].

MACHACEK (J. E.). **The effect of the yellows disease on the germinating ability of Gladiolus corms.**—*Gladiolus, 1940*, pp. 55, 57–58, 1940. [Abs. in *Exp. Sta. Rec.*, lxxxiii, 3, p. 359, 1940.]

Experiments reported to the New England Gladiolus Society appear to indicate that gladiolus corms affected by yellows are practically useless for planting, only 5 and 9 per cent. germinating, respectively, in two tests described, and disinfection with semesan being ineffectual.

McKENZIE (M. A.), JONES (L. H.), & GILGUT (C. J.). **Study practical Gardenia canker control as disease increases.**—*Flor. Rev.*, lxxxv, 2209, pp. 11–13, 3 figs., 1940. [Abs. in *Exp. Sta. Rec.*, lxxxiii, 3, p. 359, 1940.]

Investigations in Massachusetts are reported to have shown that *Gardenia* losses due to infection by *Phomopsis gardeniae* [*R.A.M.*, xix, p. 413] have increased with the general replacement of varieties of the *veitchii* group by the larger-flowered but susceptible Belmont and Hadley. The symptoms of the disease and methods for its control (including the segregation of new plants at some distance from diseased ones) are discussed.

PLAKIDAS (A. G.). **Angular leaf spot of Pittosporum.**—*Mycologia*, xxxii, 5, pp. 601–608, 4 figs., 1940.

Both green and variegated varieties of *Pittosporum* shrubs in gardens in Florida, southern Louisiana, and along the Mississippi coast are affected by an angular, chlorotic spotting. Completely necrotic spots are rare, and the infected tissue remains alive for a very long time. At first pale green, and scarcely discernible unless examined by transmitted light, the spots (which measured 1 to 5 mm. across, but sometimes coalesce and cover more than one-half the leaf area) later turn yellowish-brown on the upper and olive-brown on the lower surface. In most cases, the condition is not serious, though individual shrubs may appear chlorotic, sickly, and unsightly. Severely affected shrubs may occur next to or between others which remain unaffected, although all the *Pittosporum* plants in the region under observation (the investigation was carried out at the Louisiana Agricultural Experiment Station) belong to the species *P. tobira* and are propagated vegetatively. The disease persists through the summer and winter, though infection appears to take place only in the warm season. Inoculations outdoors of attached shoots by (1) spraying the leaves with an aqueous suspension of the spores from naturally infected leaves, (2) brushing dry spores from naturally infected to healthy leaves, and (3) placing diseased in contact with healthy leaves gave strongly positive results in three to four weeks.

Infected material showed the presence of a fungus with internal and external, hyaline, regular to irregular hyphae, 2 to 4·4 $\mu$ in diameter,

conidiophores hyaline at first becoming slightly dusky with age, 22 to 65 by 3·9 to 5·8 $\mu$, and hyaline, cylindrical to narrowly obclavate, straight or curved conidia, narrowing at the base with the point of attachment rounded or narrowly truncate, with 3 to 13 septa occasionally constricted at the septa, and measuring 34 to 143 by 3 to 4·4 $\mu$. The organism is named *Cercospora pittospori* n.sp. [with a Latin diagnosis].

BROWN (A. M.). **An aberrant strain of Puccinia helianthi Schw.**—*Canad. J. Res.*, Sect. C, xviii, 10, pp. 513–517, 1 pl., 1940.

An aberrant strain of *Puccinia helianthi* [*R.A.M.*, xvi, p. 184] was observed in haploid infections arising from germinating teleutospores on a single leaf of *Helianthus tuberosus*. Teleutospores from several other leaves of the same collection were induced to germinate, but produced only normal infections. The uredospores of the aberrant strain were paler, smoother, smaller, and more finely echinulate than those of the parent. The aberrant rust further differed from the parent strain in pathogenicity, attacking *H. tuberosus* only weakly and *H. subtuberosus* and *H. subrhomboideus* not at all, whereas the normal strain attacked all three vigorously. It was less tolerant of warm temperatures and practically inter-sterile with the parent strain. It is suggested that these differences are due to mutation involving the loss or gain of chromatin carrying more than one gene.

HOLZ (W.). **Fortschritte in der Bekämpfung von Fusicladium dendriticum (Wallr.) Fckl mit chemischen Mitteln in den Jahren 1936–1938.** [Progress in the control of *Fusicladium dendriticum* (Wallr.) Fckl by chemical means in the years 1936 to 1938.]—*Forschungsdienst*, ix, 9, pp. 278–288, 1940. [Abs. in *Hort. Abstr.*, x, 3, p. 243, 1940.]

Reviewing investigations on apple scab (*Fusicladium dendriticum*) [*Venturia inaequalis*] control in Germany from 1936 to 1938 [*R.A.M.*, xviii, p. 531], the author summarizes the present position of the problem as follows. Pre- and post-blossom spraying with standard fungicides gives the best results; the operations should be initiated before the main ascospore flight begins, in which connexion two methods of predicting the date of this event have been devised by the writer and are expected shortly to be published. The main objections to early spring Bordeaux treatment in Germany are injury to the trees, inadequate control, and shortage of copper. Spraying at full bloom with copper-lime, lime-sulphur, and nosprasit, though successful at the outset, failed to combat the disease effectively, while a new proprietary preparation, pomarsol (Ob 72), containing sulphur but no arsenic and non-toxic to bees, also proved unsatisfactory [ibid., xix, p. 26]. Experiments are in progress to obtain safe and efficacious fungicides by the extraction of plant juices in the Solanaceae, Ranunculaceae, and Compositae families, and decoctions of *Solanum nigrum* and *S. dulcamara* have already given encouraging results in laboratory trials. So far, the only work done in Germany on the inhibition of the winter development of the fungus consists in laboratory applications of nitro-lime to freshly fallen and rotting leaves, in which all perithecia of the fungus were killed.

SMOCK (R. M.) & VAN DOREN (A.). **Studies with modified atmosphere storage of Apples.**—*Refrig. Engng*, xxxviii, 3, pp. 163–166, 2 figs., 1939.

A detailed, tabulated account is given of experiments at Cornell University, New York, in which McIntosh apples were maintained until June in excellent condition and free of brown core [*R.A.M.*, xvii, p. 399] in several modified atmospheres at 40° F. Probably the best atmosphere of those tested was 5 per cent. carbon dioxide and 2 per cent. oxygen, followed by 10 per cent. carbon dioxide and 2 per cent. oxygen, and by 5 per cent. of each constituent. Held in 10 per cent. carbon dioxide and 11 per cent. oxygen, an atmosphere that could be maintained by ventilation alone, the fruit kept well until June and remained marketable for ten days at room temperature after removal from storage. This atmosphere, however, permitted the development of a slight amount of brown core late in the storage season even at 40°, the defect being much more prevalent in most atmospheres at 36°. Cortland apples responded very similarly to McIntosh as regards firmness, but proved highly susceptible to scald; this variety is therefore not recommended for modified atmosphere trials pending the development of a better method of scald control than oiled paper wrappers. Preliminary experiments on Rhode Island Greenings and Yellow Newtowns denoted encouraging possibilities in this respect (and incidentally in the elimination of [unspecified] moulds) through the use of ozone [ibid., xix, p. 479] in modified atmosphere chambers, the storage atmosphere being first treated with relatively high concentrations (e.g., 5 parts per million), which are then reduced to a non-toxic strength (1: 2) by passage through a deozonizer before returning to the chamber proper.

WALLACE (T.). **Magnesium deficiency of fruit trees: the comparative base status of the leaves of Apple trees and of Gooseberry and Black Currant bushes receiving various manurial treatments under conditions of magnesium deficiency.**—*J. Pomol.*, xviii, 3, pp. 261–274, 1940.

Further studies [which are fully described] on the base status of the leaves of apple trees and gooseberry and black currant bushes growing on similar soils under conditions of magnesium deficiency and receiving various manurial treatments [*R.A.M.*, xix, p. 605] showed that the magnesium oxide status was similar in all three kinds of fruit, though in gooseberries and black currants the levels were raised when potash was deficient or dung was applied. The evidence obtained suggested that 0·40 per cent. magnesium oxide and 20 mg. equivalents magnesium oxide per 100 gm. of dry matter are approximate levels below which magnesium deficiency will occur with all three kinds of fruit.

THORNTON (R. P.). **Peaches as a potential crop in south Florida.**—*Citrus Ind.*, xxi, 6, pp. 10–11, 17, 1940.

One of the foremost obstacles to the successful production of peaches on a commercial scale in south Florida, intermittent attempts at which have been made since 1894, lies in the extreme susceptibility of the trees to the *Clitocybe* root rot fungus [*C. tabescens*: *R.A.M.*, xviii,

p. 789], for which no remedy appears to have yet been devised. To date, in 3½-year-old plantings of the Jewel variety, 192 trees have been killed and 146 are seriously affected, most of which are not expected to survive beyond 1940, while a further 200 show mild symptoms of the disease.

Siegler (E. A.) & Bowman (J. J.). **Propagation of Sour Cherries by piece-root grafting to avoid spraying seedling stocks for leaf spot.**—*Phytopathology*, xxx, 10, pp. 873–876, 1940.

The well-known susceptibility of Mazzard cherry seedlings to leaf spot (*Coccomyces hiemalis*) largely precludes their use as a stock for the Early Richmond and Montmorency sour varieties, the numerous fungicidal treatments necessary for even partial control of the disease under average climatic conditions in the United States being too expensive to admit profitable cultivation. In experiments at the Beltsville (Maryland) Horticultural Station, however, satisfactory stands of the two sour cherries were secured by grafting them on to piece roots taken from the collar region ('top cut') of the Mazzards, Mahalebs proving less suitable for this purpose; 68 and 58 per cent., respectively, of Early Richmond and Montmorency 'took' by this method, as compared with 32 and 39 per cent., respectively, for pieces originating below the root. Stands of the former extent are regarded as quite sufficient from the nurseryman's standpoint.

Dicker (G. H. L.). **On Rubus aphides and leaf-hoppers as possible vectors of Raspberry mosaic.**—*J. Pomol.*, xviii, 3, pp. 275–286, 1 fig., 1940.

Attempts at East Malling to find an insect vector of raspberry mosaic [*R.A.M.*, xix, p. 293] having proved unsuccessful, the author made a survey of the fauna of cultivated forms of *Rubus*, and carried out transmission tests with likely vectors. Eight species of aphids and seven of leafhoppers were found, but the evidence obtained made it possible to eliminate all of these, except the ubiquitous *Amphorophora rubi* and *Aphis idaei*. Trials with these two insects failed to demonstrate transmission; the number of unhealthy plants in the inoculated units suggested that one or both may, perhaps, transmit mosaic, but if so, the symptoms do not appear until the following summer. The inconclusive results of these experiments may, possibly, be explained by the discovery that the Lloyd George raspberry is a symptomless carrier of the most serious form of mosaic [loc. cit.].

While mosaic is the most prevalent and important disease of *Rubus* spp., certain varieties are also affected by other diseases that appear to be of virus origin. Symptoms resembling dwarf [ibid., xvii, p. 473] have been observed in Great Britain on phenomenal berry [a distinct pomological variety of *R. loganobaccus*] and cut-leaved blackberry [*R. laciniatus*], as well as (to a less extent) on Himalaya [*R. procerus*] and Black Diamond blackberries, youngberry, and boysenberry. Two isolated cases have occurred on raspberries at East Malling, on MacLaren's Prolific in 1938, and a hybrid seedling in 1939. A mosaic has occasionally widely affected Bedford Giant raspberries.

HEUBERGER (J. W.). **A laboratory biological assay of tenacity of fungicides.**—*Phytopathology*, xxx, 10, pp. 840–847, 1 graph, 1940.

A tabulated account is given of the writer's investigations at the Connecticut Agricultural Experiment Station on the development of a simple, rapid, and effective laboratory washing test for use in the evaluation of fungicidal tenacity (defined as the ability of a fungicide to resist weathering) [*R.A.M.*, xvi, p. 695].

The so-called 'rapid test', simulating the washing and beating action of rain in nature, was carried out as follows. A standard moist chamber half (221 by 75 mm.) was filled with water, in which were immersed for $\frac{7}{8}$ of their length after $1\frac{1}{2}$ hours' drying, two sprayed slides, the sprayed surfaces facing outwards: these were drawn rapidly across from one side to the other, raised from the water, sharply jerked, re-immersed, drawn rapidly back across to the opposite side, and so forth for 20 strokes, a period of 20 seconds being required for the entire process. The fungicidal value of the unwashed and washed deposits was assayed by methods recently described [ibid., xix, p. 665].

In comparative tests the rapid method was found to be as effective as other tests in removing fungicidal deposits and its superior speed is an advantage.

The applicability of the rapid test to the determination of fungicidal tenacity was tested as follows. Each of a paired series of coated slides was sprayed with Bordeaux, red copper oxide, yellow copper oxide, basicop, compound A, copper hydro 40, coposil CDV, and Z–O, using a precision sprayer [ibid., xx, p. 27], in such a way as to give deposits of known quantity over the range of 0 to 100 per cent. spore inhibition with *Macrosporium* [*Stemphylium*] *sarciniforme*; after $1\frac{1}{2}$ hours' drying, one slide of each pair was given 20 strokes, the fungicidal value of the washed and unwashed deposits being then ascertained in the usual way. The tenacity of the various materials was evaluated as follows. The data on spore inhibition for both the washed and unwashed deposits were plotted on the same sheet of logarithmic probability paper [ibid., xviii, p. 753], using the ordinate for percentage spore inhibition and the abscissa for original deposits in micrograms per sq. cm. in both cases. A straight line was fitted to each set of data for the points between 10 and 90 per cent. spore inhibition. The situation of the line for washed deposits below that for the unwashed shows that some of the initial deposit was removed by washing. The L(ethal) D(ose) 50 point on each line was determined by inter- or extrapolation, and the LD 50 deposit for the unwashed slides divided by that for the washed ones, the quotient measuring the amount of the deposit adhering during washing. For instance, a quotient of 1·00 (unity) indicates that none of the deposit is removed by washing, whereas one of 0·40 signifies that 40 per cent. adhered. The quotient thus serves as a measure of relative tenacity and is termed the 'tenacity coefficient'. The following values were obtained (averages of two to three tests): Bordeaux 0·880, red copper oxide 0·855, yellow copper oxide 0·834, basicop 0·544, compound A 0·467, copper hydro 40 0·340, coposil CDV 0·333, and Z–O 0·316. The order of tenacity of Bordeaux, red copper oxide, and coposil CDV agrees with the data reported by Magie and Horsfall (abs. in *Phytopathology*, xxvi, pp. 100–101, 1936) for similar materials on apple and

cherry foliage in the field in 1934 and 1935, based on chemical analysis of deposits before and after rain. The writer's results, except as regards basicop, also agree in essentials with those of McCallan and Wilcoxon [*R.A.M.*, xvii, p. 540], based on chemical analysis of deposits before and after one minute of 'artificial rain'.

The copper compounds used in these tests did not contain appreciable quantities of spreader, the inclusion of which necessitates a correction in the data, since the drops of spore suspension do not cover the same area on washed and unwashed deposits owing to the removal by washing of much of the adhesive. The same number of spores are thus exposed to different amounts of deposit.

TURNER (C. N.). **Wear in sprayer nozzle disks.**—*Agric. Engng, St Joseph, Mich.*, xxi, 10, pp. 393–394, 405, 4 figs., 1940.

In a study of the failure of parts of potato-sprayers owned by 85 growers in Aroostook County, Maine, the writer found that nozzle disk defects represented 64 per cent. of the total number of failures, among the factors involved in which are the type and concentration of disinfectant used in the spray mixture; the amount of foreign material, such as sand, in the water supply; the pressure applied to the mixture at the nozzle aperture; the size of the disk orifice; variations in the construction of the nozzle, especially the whirl plate; and the composition and thickness of the nozzle disk.

Experiments showed that wettable sulphur (2 lb.), lead arsenate (1 lb.), and hydrated lime (2 lb.) in 25 gals. water caused little wear, except to the Hardie disk (Hardie Manufacturing Co., Hudson, Mich.), which underwent severe chemical corrosion in a test lasting 18 hours at a pressure of 380 lb. per sq. in. Single-strength Bordeaux mixture (2–2(hydrated lime)–25, 12 hours, same pressure) was responsible for most of the wear on disks Nos. 2, 3, and 4 (monel 'K' in the 'as-rolled' condition, 'Z' nickel 'as-rolled', and inconel, respectively), all cold-rolled, full hard temper, supplied by the International Nickel Co., New York, the deleterious effect of the same spray at double strength being still more marked. Using Republic 17–17 steel as a check in two tests (double-strength Bordeaux, 380 and 460 lb. per sq. in.), disk No. 7 of U.S.S. '12' steel (Carnegie-Illinois Steel Corp., Cincinnati, Ohio) proved to be the most resistant to wear of any of the ten metals tested, followed by inconel, heat-treated 'Z' nickel, and Allegheny '12' steel (Allegheny Ludlum Steel Corp., Brackenridge, Pa).

A $\frac{4}{64}$ in. drilled hole in material 0·032 in. thick does not form a true orifice but makes a cylindrical hole, the sharp inside edges of which showed the only signs of wear on the entire disk; these were rounded off in less than one hour's run in the test with double-strength Bordeaux at 460 lb. per sq. in. Such wear not only increased the rate of discharge but also changed the character of the spray zone. Increase in diameter of the orifice reported by other workers was not observed in these trials.

**Proceedings. Discussion on plant diseases and the weather.**—*Trans. Brit. mycol. Soc.*, xxiv, 2, pp. 264–266, 1940.

The following aspects of the connexion between climatic conditions

and plant diseases were discussed at a meeting of the British Mycological Society on 19th February, 1940.

W. C. Moore cited a number of examples from the Ministry of Agriculture's monthly summary of plant disease records showing the influence of seasonal factors on various fungi. For instance, a wet May is thought to portend severe outbreaks of apple scab [*Venturia inaequalis*], chocolate spot of [broad] beans [*Botrytis cinerea*: ibid., xvi, p. 724] may be expected to follow a dull, showery period between April and July, and clover rot [*Sclerotinia trifoliorum*: ibid., xvii, p. 825] is favoured by a mild winter succeeding a wet autumn [ibid., xviii, p. 319]. The rapid diffusion of *Antirrhinum* [*majus*] rust [*Puccinia antirrhini*] in a destructive form in England was undoubtedly initiated by a series of hot summers commencing in 1933 [ibid., xiii, p. 445]. Virulent outbreaks of gooseberry cluster cup rust [*P. pringsheimiana*] followed a dry March in 1929, 1931, and 1933: it has been suggested by A. Smith that under these conditions, germination on the alternate sedge [*Carex*] host is temporarily delayed and then occurs in profusion at a time when the gooseberry foliage provides a wide surface area for spore colonization. A fairly severe attack in 1938 was forecast on the basis of these observations.

Dealing with the influence of weather on apple canker (*Nectria galligena*) [ibid., xix, p. 27], R. W. Marsh stated that ascospore discharge had been shown by means of vaselined slide spore traps to be very closely correlated with the volume of precipitation, but not with temperature, humidity, wind, or sunlight. The tolerance of low temperatures by the fungus, combined with its high rate of spore production from the autumn to the spring, contributes appreciably to its successful infection of the dormant tree through leaf scars, scab [*V. inaequalis*] lesions, woolly aphis [*Eriosoma lanigerum*] galls, or pruning cuts and wounds in the bark. Leaf scar infection can take place in the spring or autumn, but not in mid-winter, when it is quite possible, however, for the organism to enter through pruning cuts. Freshly inflicted wounds are the most susceptible, so that pruning should be carried out during cold, dry periods when the cut tissues can acquire resistance through ageing before spore discharge is resumed.

R. V. Harris described experiments in which dwarf-lateral scorch and die-back [ibid., xix, p. 690] developed in Lloyd George raspberries kept in a greenhouse with a mean temperature of 48° F. during December and January, but not in those placed in a cold storage chamber at 31·5°, both series being subsequently transferred to a cool orchard house until the following winter. Among the affected plants, 81 per cent. of the fruit canes died, and the leaf, crown, and root symptoms resembled those occurring in the field, vegetative growth of the stool being stimulated. The Baumforth's Seedling B variety underwent no change at the mild winter temperature, but in further tests die-back occurred on loganberry, phenomenal berry [a pomological variety of *Rubus loganobaccus*], and Himalaya berry [*R. procerus*] cool-stored at 40°.

Observations since 1935 by Mary E. King and R. V. Harris on soil temperature and rainfall in relation to yellow edge of Royal Sovereign strawberry [ibid., xix, p. 716] revealed a connexion between

intensity of infection and weather conditions in the preceding week or fortnight. Temperatures do not usually rise to a height conducive to the disorder before June or July, after which the decline in the soil moisture content restricts its development, even during hot weather, until the advent of damper conditions. In the final phase of the disease in late autumn, the falling temperature imparts a milder character to the symptoms, although the soil moisture remains at saturation point. On the basis of these data, appropriate conditions for roguing, which is best affected when the disease is at its height, can be forecast.

H. M. Moore discussed the bearing of weather conditions on the timing of the spraying schedules for the control of *Venturia inaequalis* on apple and *Sclerotinia laxa* on Morello cherries [ibid., xviii, p. 461].

Potato blight and the weather was the subject of a paper by A. Beaumont, based on extensive experience in Devon and Cornwall [ibid., xvii, p. 583].

T. H. Harrison summarized his conclusions regarding the influence of the widely variable climate of Australia on brown rot of stone fruits (*S. fructicola*) [ibid., xiv, p. 704].

**Agriculture in Uganda.**—xvi+551 pp., 30 pl., 8 figs., 1 graph, 5 col. maps, London, Humphrey Milford, Oxford University Press, 1940. 20s.

This handbook, stated in the introduction by J. D. Tothill to be intended as a companion volume to 'Uganda' (1935), presents in an attractive and readable form much valuable information on agriculture and cognate subjects, such as land tenure, climate, soils, and topography, each treated by an expert in the particular field under discussion, the work as a whole being 'in every sense a Departmental effort'. Fully descriptive observations on the etiology, symptomatology, mode of dissemination of the pathogens, varietal reactions, control, and other points of interest in connexion with the diseases of bananas, cassava, groundnuts, cotton, rice, coffee, sugar-cane, tea, tobacco, rubber, and other crops are contributed by C. G. Hansford, who also served as chairman of the committee set up under Government auspices to carry out the project.

Large (E. C.). **The advance of the fungi.**—488 pp., 6 pl., 52 figs., 3 diags., 2 graphs, 1 map, London, Jonathan Cape, 1940. 18s.

This excellent survey of the growth of the science of plant pathology, from its beginning in the eighteenth century to the present day, though written in language that an intelligent layman can understand, will be read with pleasure and profit by the most professional mycologist or plant pathologist.

The story is not written in strict chronological order, but consists of 31 chapters, including (i) The potato murrain, (ii) Famine in Ireland, (iii) *Oidium* on the vines, (iv) Fruits of the fungi, (v) The bunt of the wheat, (viii) Enter Louis Pasteur, (xv) Coffee rust in Ceylon, (xvii) Bordeaux mixture, (xxix) New sprays for old, and (xxxi) Towards immunity. There is a bibliography of 26 pages and an index of 12 pages.

Interest is added by including some background of political, economic, or social effects, comment on mycologists and others, touches of

humour and philosophy. The author writes with authority in his own field of chemistry, especially that of sprays and dusts, but he has prepared a well-balanced, comprehensive, scientific treatise on the development of plant pathology.

LEVINE (A. S.) & FELLERS (C. R.). **Action of acetic acid on food spoilage micro-organisms.**—*J. Bact.*, xxxix, 5, pp. 499–514, 1 pl., 1940.

Acetic acid in nutrient broth inhibited the growth of various micro-organisms associated with food spoilage in studies at the Massachusetts Agricultural Experiment Station, the effective concentration for *Aspergillus niger* being 0·27 per cent. (lethal at 0·59) at a $P_H$ of 4·1 (lethal at 3·9) and for *Phytomonas* [*Bacterium*] *phaseoli* (inhibitory and lethal) 0·02 per cent. ($P_H$ 5·2) [*R.A.M.*, xix, p. 667]. Acetic acid was more toxic to *A. niger* than either lactic or hydrochloric acid at a higher $P_H$ value. In the presence of lactic acid at non-toxic concentrations the mould produced a heavy, rubbery mat unlike the growth formed with acetic or hydrochloric acid. It is concluded that the toxicity of acetic acid to the organisms under observation is a function, not only of the hydrogen-ion concentration, but also of the undissociated acetic acid molecule.

PRICE (W. C.). **Acquired immunity from plant virus diseases.**—*Quart. Rev. Biol.*, xv, 3, pp. 338–361, 5 figs., 1940.

This is a fuller discussion of acquired immunity from plant virus diseases than that already noticed from another source [*R.A.M.*, xix, p. 487]. Most of the papers in the bibliography of 118 titles have been recorded from time to time in this *Review*.

STANLEY (W. M.). **The biochemistry of viruses.**—*Ann. Rev. Biochem.*, ix, pp. 545–570, 1940.

The author reviews and discusses, with numerous references to the relevant literature, the information at present available on the biochemistry of viruses. The points dealt with include isolation methods, chemical composition of viruses, X-ray studies, size and shape of viruses, and the properties of the tobacco mosaic virus. A bibliography of 180 titles is appended.

BAWDEN (F. C.) & PIRIE (N. W.). **The inactivation of some plant viruses by urea.**—*Bio-chem. J.*, xxxiv, 8–9, pp. 1258–1277, 1 graph, 1940.

Experimental evidence is presented demonstrating that the four viruses, tobacco mosaic, potato X, tomato bushy stunt, and tobacco necrosis were irreversibly denatured by urea [*R.A.M.*, xviii, p. 630], the process being accompanied by loss of infectivity and serological activity. For each virus there was a critical concentration of urea, below which no irreversible effect was exercised on infectivity. Inactivation was considerably expedited by the presence of alkali. The rate of inactivation was lowest at about 20° C. and greatly increased at —10°. The inactivation of purified tobacco mosaic virus by urea was only slightly slower than that of virus in crude infective sap.

Inactivation of tobacco mosaic and potato virus X, but not that of the remaining two viruses, was accompanied by separation of the nucleic acid and protein.

Bawden (F. C.) & Pirie (N. W.). **The effects of alkali and some simple organic substances on three plant viruses.**—*Bio-chem. J.*, xxxiv, 8–9, pp. 1278–1292, 1940.

Experiments are described in which a study was made of the effects of alkali, sodium dodecyl sulphate, urethane, guanidine, pyridine, picoline, lutidine, aniline, nicotine, phenol, sodium salicylate, sodium benzoate, and sodium hippurate on the viruses of tobacco mosaic and tomato bushy stunt, and some tests are also recorded on potato virus X [cf. *R.A.M.*, xviii, p. 266]. The effect of alkali [see preceding abstract] on tobacco mosaic virus is complex; treatment at $P_H$ 9·3 may increase infectivity, at $P_H$ 10·5 cause loss of infectivity but not serological activity, and at $P_H$ 11 total loss of all characteristics. In the presence of alkali, sodium dodecyl sulphate readily destroyed the viruses, separating the nucleic acid from the proteins. Except nicotine and arginine, which formed with tobacco mosaic reversible, fibrous precipitates, all the material tested (at concentrations below 4M) inactivated the viruses in neutral solution.

Pirie (N. W.). **The criteria of purity used in the study of large molecules of biological origin.**—*Biol. Rev.*, xv, 4, pp. 377–404, 1940.

In this discussion on criteria of purity of substances such as plant virus proteins, the types of observation generally made and presented as evidence of purity are considered under seven headings. The least reliable methods are chemical analysis and crystallinity, while serological tests can only reveal the absence of suspected contaminants. The measurement of end points, whether by serum precipitation or infection, is subject to several errors, and at best can only indicate the possibilities of serological activity or infectivity of the major constituent of a preparation. Electrophoresis, ultracentrifugation, and solubility and partition measurements based on the principles of the phase rule are considered to afford the most satisfactory evidence of purity at present available, but there are various reasons to question the reliability even of these methods.

Wheldon (R. M.). **'Mutations' in Aspergillus niger bombarded by low voltage cathode rays.**—*Mycologia*, xxxii, 5, pp. 630–643, 4 figs., 1940.

When spores of *Aspergillus niger* were submitted to bombardment in vacuum by low-density beams of low-velocity electrons, comparable in density and range with the secondary electrons released in spore tissues under X-ray bombardment, variant strains were produced, mostly referable to five distinct types. One strain, when the spores were mature, varied in colour from avellaneous to wood-brown. A second, at the same growth stage, was Saccardo's umber. A third was mummy brown. A fourth, which was noted only twice, had a brilliant citron-yellow mycelium in the early growth stages, the older portions, as the culture matured, becoming pyrite-yellow, while the mature

spores were brownish, and much darker than the mycelium. The fifth was a 'giant' variant, the spores of which were black, but averaged 4 $\mu$ in diameter, as against 3·5 $\mu$ for the species and all the other variants. Continued through several asexual generations, these five variants showed no appreciable change. It was calculated that at the voltage used (about 12 electron kilovolts) the electrons penetrated deep enough to release most of their energy in the nuclear region. The evidence indicated that the observed effects were due to changes in the nucleus and may be regarded as mutations. In the large variant twice as many chromosomes were present as in the normal form, but in other respects the cytology of all the variants was the same as that of the species. Several repetitions of the experiments gave comparable results.

HENSON (L.). **The production of apothecia of Sclerotinia sclerotiorum and S. trifoliorum in culture.**—*Phytopathology*, xxx, 10, pp. 869-873, 1940.

The writer's technique for the production of stipes and apothecia by *Sclerotinia sclerotiorum* and *S. trifoliorum* [*R.A.M.*, iv, p. 481] consists in placing sclerotia of the two species on 1 per cent. water agar, slanted in 8·5 by 2 cm. vials tightly plugged with cotton, and leaving them without further attention under any desired conditions of light and temperature for six months or longer. In cultures kept out-of-doors at Lexington, Kentucky, *S. trifoliorum*, planted in the late summer, fruited most profusely from October to December, whereas *S. sclerotiorum*, initiated at the same time, did not mature until February to April. Observations on 105 isolates of *S. trifoliorum* and 28 of *S. sclerotiorum* showed that germination usually occurred in 75 to 85 per cent. of the cultures planted on any one date between 31st August, 1934, and 11th October, 1935, each sclerotium producing an average of over 1·5 apothecia. A temperature of about 14° C. was found to be the optimum for stipe formation in both species, the average exposures required for *S. trifoliorum* and *S. sclerotiorum* being 15 to 20 and 45 to 50 days, respectively (minimum 6 and 21, respectively).

A similar technique has been used for the development of the perfect stage of *Claviceps purpurea* [ibid., viii, p. 560], sclerotia of which from rye were planted on water agar on 11th September, one lot being placed outdoors and the other in a cold room at 3°; by the middle of the following April, part of each lot had produced stipes, while those outdoors had also matured and discharged ascospores.

LOUGHNANE (J. B.). **A survey of the aphis population of Potato crops in Ireland in relation to the production of seed Potatoes.**—*J. Dep. Agric. Éire*, xxxvii, 2, pp. 370-382, 1 graph, 1 map, 1940.

It is apparent from the results of the present survey that the number of potato-feeding aphids in the seed-producing areas in Counties Donegal, Sligo, Galway, Clare, Westmeath, Dublin, and Kildare is low, mainly owing to the scarcity of suitable winter food plants. Observations at the Albert Agricultural College, Glasnevin, point to the over-wintering of *Myzus persicae*, the chief agent of virus transmission, in the viviparous state on winter crucifers [*R.A.M.*, xviii, p. 197], which

are only grown, however, in urban districts remote from the seed-producing areas in question, and are therefore unlikely to constitute a source of spring infestation by winged migrants. A further safeguard against the conveyance of viruses by this means lies in the atmospheric conditions of the coastal regions of the West of Ireland devoted to seed potato production, which appear to be generally unfavourable to aphid movement. It is practicable in these circumstances to maintain a high level of health in the seed-producing areas under discussion, which were, in fact, freed from leaf roll infection, introduced in new stocks, by the simple precaution of careful inspection and roguing. In the light of these data, the present situation in regard to the isolation of seed potato stocks in Ireland from potential sources of virus infection may be deemed satisfactory.

RAMSAY (J. T.). **Raising the standard of Potato stocks.**—*J. Dep. Agric. Vict.*, xxxviii, 10, pp. 479–482, 7 figs., 1940.

In connexion with the establishment in Victoria of a potato seed certification scheme, notes are given on the following deviations from correct plant type or diseases against which growers must guard by thorough roguing: bolters, wildings [*R.A.M.*, xx, p. 30], *Rhizoctonia* [*Corticium solani*], blackleg (*Bacillus phytophthorus*) [*Erwinia phytophthora*], and the viruses (estimated to cause an annual loss of 25 to 30 per cent. in Australia) leaf roll (to which Up-to-Date is the most susceptible commercial variety under local conditions), mosaic, streak, and crinkle.

**U.S.A.: surveys of Rubber producing possibilities in tropical American countries.**—*Chron. bot.*, vi, 2, pp. 39–40, 1940.

A number of high-yielding varieties of *Hevea* rubber trees in tropical America have been found, in the course of an exploration of rubber-producing potentialities now in progress under the auspices of the United States Department of Agriculture, to be sufficiently resistant to the South American leaf disease [*Dothidella ulei*: *R.A.M.*, xv, p. 314; xix, p. 736] to reduce the seriousness of this factor, and the development of these strains on a commercial scale is planned.

VANDECAVEYE (S. C.) & KATZNELSON (H.). **Microbial activities in soil: VI. Microbial numbers and nature of organic matter in various genetic soil types.**—*Soil Sci.*, l, 4, pp. 295–311, 3 graphs, 1940.

In continuation of studies which have been in progress for some years at the Washington Agricultural Experiment Station on the microbial activities of the soil [*R.A.M.*, xv, p. 174], the writers determined the numbers of bacteria, fungi, Actinomycetes, and cellulose-decomposing bacteria in representative samples of various horizons of 15 soil types in relation to the nature and chemical composition of the humified organic matter. The average number of fungi was found to range from 2,133 to 738,750 per gm. of soil in the A, and from 1,313 to 258,750 in the B horizons. The soils supporting the most abundant fungal growth were various types of loam, notably Helmer silt, a brown forest soil developed on loessial material, bacteria tending to predominate in grassland. No significant relation was found to exist

between the total content of humified organic matter in the soils and their microbial populations.

Kadow (K. J.) & Anderson (H. W.). **A study of Horse-radish diseases and their control.**—*Bull. Ill. agric. Exp. Sta.* 469, pp. 531–583, 23 figs., 1940.

The following information concerning horse-radish diseases and their control in Illinois is presented as a result of studies initiated in 1933. White rust [or white blister] (*Albugo candida*) [*Cystopus candidus*: *R.A.M.*, xviii, p. 365] is the most destructive foliar disease of the crop. The physiologic race of the fungus [ibid., xiv, p. 1] occurring on horse-radish was shown by experiments in the authors' laboratory to attack only a few of the other crucifers investigated. The organism was found to overwinter in the crown and thence to infect the new shoots arising in the spring and developing into the hundreds of 'volunteers' commonly observed in fields planted to horse-radish in the previous year. It did not, however, penetrate to the point at which the lateral roots used for sets are produced, and overwintering through this channel is probably very rare in the Middle West, though field observations in 1940 show that this mode of perpetuation is not excluded, one plant in 1,000 in one field, and one in 5,000 in another developing the typical pustules of systemic infection in the absence of 'volunteers'. The results of four years' experiments in combating *C. candidus* by copper and sulphur sprays and dusts were not encouraging, and the most promising line of control is thought to consist in the development of resistant varieties of the Bohemian type.

Bacterial leaf spot (*Phytomonas* [*Bacterium*] *campestre* [var.] *armoraciae*) [ibid., viii, p. 543], first observed in Illinois in 1934, assumed a destructive form in the wet season of 1938, according to H. W. Anderson and Thornberry (*Plant Dis. Reptr*, xxii, p. 366, 1938).

*Cercospora armoraciae* Sacc., reported from Nebraska eastwards in the United States and from Canada, is sometimes responsible for severe injury to the leaves. The fungus is characterized by acicular, hyaline, 3- to 7-septate conidia, 100 to 180 $\mu$ in length, borne singly at the tips of simple, dark brown conidiophores, 30 to 40 $\mu$ long, and produces on the foliage pale grey spots, later darkening to nearly black, sometimes concentric lesions, $\frac{1}{2}$ to $\frac{3}{4}$ in. in diameter, which tend to coalesce and cover large areas of the leaf.

*Ramularia armoraciae* [*R.A.M.*, xviii, p. 365] appears from reports from Poland, the U.S.S.R., the United States, and Canada to be virtually co-extensive with its host. Like *C. armoraciae*, with which it is liable to confusion by reason of the similarity of the lesions, this fungus has not hitherto been considered sufficiently important to justify special control measures.

Minor foliar disorders of horse-radish are caused by *Alternaria brassicae* [? *A. oleracea*: loc. cit.] (rare in Illinois), *Macrosporium herculeum* [*A. brassicae*], the spots associated with which are much smaller than those of the foregoing, *Septoria armoraciae* [loc. cit.], inducing symptoms resembling those of *R. armoraciae* but not yet known to occur in America; *Phyllosticta armoraciae* (restricted to Europe); *P. decidua*, probably not a parasite but often observed in conjunction with other

leaf spots; *P. orbicula*, recorded from Ontario and New York as the agent of a small, definite, white spot with sparse pycnidia; surface mildew (*Erysiphe polygoni*) [loc. cit.], uncommon in America; downy mildew (*Peronospora parasitica*) [ibid., xvi, p. 360]; black streaking of the leaf petioles, originating in the form of spots $\frac{1}{8}$ to $\frac{1}{4}$ by $\frac{1}{16}$ in. which gradually elongate into coalescent, sunken streaks, 1 to 2 in. long, extending from below the epidermal layer into the cortex to a depth of five or six cells, where a gum-like, dark brown deposit is formed (this condition is almost universal in the cultivated horse-radish, and if it constitutes a form of mosaic [ibid., xii, p. 351; xiv, p. 731], most commercial plantings must be regarded as virus-infected); and chlorosis of genetic origin, observed in Illinois and also reported (*in litt.*, 1935) by Baudyš from Czechoslovakia and Schleyer from Germany (*Vjschr. Bayer. LandwRat.*, xii, pp. 1–68, 1907).

Virus diseases, besides mosaic, include curly top, also known as 'brittle root' [ibid., xvi, p. 225] or 'wilt' and possibly a form of deterioration or 'running-out' of 'old-line' (home-grown) sets, the infective principle presumably increasing in the latter through asexual propagation from year to year. In 1938 and 1939 the yields at Collinsville from sets originating in the north of the State in the same years were over 115 per cent. heavier than those from the local stock, while even after four years of transplantation the former were still giving an increase of 54 per cent. over the latter.

The etiology of 'root blackening', 'core rot', and 'red brittleness' [ibid., xvi, p. 361] is obscure, the first-named probably comprising several distinct troubles, including curly top. Experiments are described showing that an important part in the development of root rots is played by injuries inflicted in the process of 'lifting', a commercial practice involving the removal of the side roots from the cuttings once or twice during the summer, usually under moist conditions, leaving only those at the extreme end to absorb nourishment for growth: in one test 21 per cent. of unmarketable and 87 per cent. diseased roots were counted as a result of this treatment, compared with only 2 per cent. unmarketable and 11 per cent. diseased in an undisturbed planting.

The importance of the root rot problem in Illinois was thought to justify a study of the factors concerned, which was undertaken by C. Wutzke, who states (in an unpublished report) that over 60 bacteria were isolated from the material at his disposal, many capable of causing decay independently, while others did so only in various combinations. *P.* [*Bact.*] *phaseoli* was the only one of these organisms previously described as the agent of a vegetable disease, and cross-inoculation experiments with this pathogen resulted in the development of typical blight lesions on bean [*Phaseolus vulgaris*] leaves and 'core rot' of horse-radish. A common symptom of internal bacterial infection is a stringy mass of fibres in the core; a few of the species isolated were able to destroy the epidermal and cortical cells. Incipient vascular discoloration and epidermal decay of bacterial origin are prevalent in stored roots and sets.

Pötschke attributed the above-mentioned root blackening to a species of *Verticillium* [ibid., iii, p. 11; cf. ibid., xvii, p. 10], whereas other

workers regard this disturbance as non-parasitic: in all probability these conflicting opinions arise from the fact that there are several root rots of diverse origin with virtually identical symptoms requiring cultural and pathogenicity tests for their accurate diagnosis.

*Rhizoctonia* root rot of horse-radish occurs in various parts of the United States. The species concerned in Czechoslovakia was identified by Baudyš (*in litt.*, 1935) as *R. violacea* [*Helicobasidium purpureum*], the pathogenicity of which and its amenability to control by finely ground sulphur and germisan were demonstrated. The writers have also obtained good results with 325-mesh sulphur dust. A species culturally and morphologically similar to *R.* [*Corticium*] *solani* was isolated from horse-radish in Illinois and shown by inoculation tests to be parasitic on the same host. In 1934 and 1935 it caused heavy losses in roots and sets stored in pits. Infection usually takes place at the crown or through wounds in the roots. Limited observations suggest that *C. solani* is an important factor in the development of rot in roots exposed to direct sunshine in the pits, entry being effected through shoots that have sprouted prematurely and have been killed by frost. The diseased tissues are pale yellow to light dirty grey and friable; in advanced stages black sclerotia may be detected among the white mycelium.

The species of *Penicillium* [cf. ibid., xvi, p. 361] associated with a prevalent root rot of horse-radish in Illinois, covering the surface with its greenish-blue spore masses and causing an average loss of 2 to 10 and a maximum of 40 per cent., was identified by C. Thom as *P. hirsutum* Dierckx. It gave positive results in inoculation tests on stored roots only, denoting that its parasitism is of a weak order. Like the very similar disease caused by *C. solani*, the *Penicillium* root rot may be combated by dusting with sulphur. Both *Rhizoctonia* and *Penicillium* rots are serious, in some seasons causing losses of 50 per cent. of the crop.

*Thielavia* [*Thielaviopsis*] *basicola* is reported to have caused substantial damage to the New Jersey horse-radish crop.

Minor root disorders include waterlogging of the roots (in Germany and Czechoslovakia), girdle disease (Germany) [ibid., ix, p. 156], club root (*Plasmodiophora brassicae*), first reported from Germany in 1907 and also occurring in Illinois, *Pezizella dilutella* and *Lachnum sulphureum* in Germany, *Gibberella saubinetii* and *Fusarium oxysporum* in Denmark, *Rhizopus nigricans* in Illinois, hollow root, first reported from England in 1888 and serious in Illinois in 1934, and *Sclerotinia sclerotiorum* and *Pseudomonas* [*Bact.*] *tumefaciens* in Germany [ibid., xvi, p. 361].

The paper concludes with a table showing the distribution of the various diseases in the United States, with the authority and date for the first observation in each case, and a bibliography of 116 titles.

Drummond (O. A.). **Enrolamento das folhas da Cana de Açúcar.** [Leaf roll of Sugar-Cane.]—*Ceres*, i, 1, pp. 71–73, 2 figs., 1939. [English summary. Received December, 1940.]

*Myriogenospora paspali* (which the author, following Diehl, regards as identical with *M. aciculisporae* [*R.A.M.*, xiii, p. 706]) was observed

in Minas Gerais, Brazil, for the first time in the province, in 1938, causing a leaf disease of sugar-cane of minor economic importance [ibid., xviii, p. 624]. The outer leaves split longitudinally and adhere tightly to the inner ones instead of unfurling normally. *Paspalum conjugatum* and *Imperata brasiliensis* are other local hosts of the fungus.

RAMSBOTTOM (J.). **Taxonomic problems in fungi.**—*ex* New Systematics, Oxford, Clarendon Press, pp. 411–434, 1940.

In this contribution the author reviews from the taxonomic standpoint the advance of knowledge in the fungi with regard, *inter alia*, to saltation, dual phenomenon, heterothallism, hyphal anastomosis and hybridity, specialized parasitism (in the rusts), hybridity in smuts, and morphological classification of the Basidiomycetes.

CUMMINS (G. B.). **Descriptions of tropical rusts—III.**—*Bull. Torrey bot. Cl.*, lxvii, 7, pp. 607–613, 2 figs., 1940.

This is a critically annotated list of 21 Guatemalan rusts, of which nine are new [with Latin diagnoses]. *Cumminsiella standleyana* n.sp. on *Berberis fascicularis* differs from the related *C. sanguinea* [*R.A.M.*, xviii, p. 654] in the scattered pores of its uredospores and the shorter and more fragile pedicels of the teleutospores. *Peridermium montezumae* n.sp. occurs on *Pinus montezumae*.

KERN (F. D.) & THURSTON (H. W.). **A further report on the Uredinales of Colombia.**—*Mycologia*, xxxii, 5, pp. 621–629, 1940.

Critical and taxonomic notes are given on 22 species of Colombian rusts, this list adding 11 to the number reported in 1933 [*R.A.M.*, xiii, p. 326], and bringing the total up to 226. Two new species are included, together with *Puccinia capsicicola* nom. nov. (*Aecidium capsici* Kern & Whetzel, *J. Dep. Agric. P. R.*, xiv, p. 341, 1930, not *P. capsici* Major, *Mém. Soc. neuchâtel. Sci. nat.*, v, p. 501, 1913).

HIRATSUKA (N.). **Additional notes on Uredinales of Shikoku.**—*J. Jap. Bot.*, xvi, 6, pp. 327–329, 1940.

Continuing his studies on the rust flora of Japan [*R.A.M.*, xix, p. 729], the author enumerates a further ten species supplementary to his earlier list of Uredinales of Shikoku (*Mem. Tottori agric. Coll.*, iii, pp. 249–377), among which may be mentioned *Chrysomyxa tsugae* on *Tsuga sieboldii* [*R.A.M.*, xvii, p. 347] and *Puccinia lolii* [*P. coronata*] on *Avena fatua*. Six new rust hosts are also listed, including *Anemone nikoënsis* for *Tranzschelia* [*P.*] *pruni-spinosae* [ibid., xix, p. 418].

SEELER (E. V.). **A monographic study of the genus Thyronectria.**—*J. Arnold Arbor.*, xxi, 4, pp. 429–460, 5 pl., 1940.

This monograph opens with a critical taxonomic discussion of the characters of the genus, following which are descriptions of 16 species of *Thyronectria* [*R.A.M.*, xix, p. 734], including three new ones [with Latin diagnoses] and eight new combinations. A new subgenus *Gyrostromella* [with a Latin diagnosis] is erected to accommodate the species of *T.* with *Gyrostroma* as their conidial stage.

MENDOZA (J. M.) & LEUS-PALO (SIMEONA). **A revision of the genus Psalliota in the Philippines.**—*Philipp. J. Sci.*, lxxii, 3, pp. 337–347, 8 pl., 1940.

Fries's interpretation of the name of *Psalliota* as comprising only Agarics with purple or reddish spores, more or less fleshy plants, and free gills, in contradistinction to Linnaeus's conception of *Agaricus*, characterized by varicoloured spores, membranaceous, persistent gills, and a floccose, putrefying trama, is applied to the revision of 13 species occurring in the Philippines, involving the establishment of three new combinations. *P. campestris* was introduced into the country as a result of the attempted cultivation of this species with imported spawn and large quantities of it have been gathered in Pasig, Rizal Province.

PADWICK (G. W.). **The genus Fusarium III. A critical study of the fungus causing wilt of Gram (Cicer arietinum L.) and of the related species of the subsection Orthocera, with special relation to the variability of key characteristics.**—*Indian J. agric. Sci.*, x, 3, pp. 241–284, 1940.

In continued studies on the genus *Fusarium* [*R.A.M.*, xviii, p. 780] cultures from Baarn of all but one of the twelve species or forms comprising the subsection *Orthocera* (the twelfth, *F. conglutinans* var. *citrinum* not being available) were examined in comparison with the three fungi causing wilt of gram (*Cicer arietinum*) in India [loc. cit.]. The results obtained are fully tabulated and show that in respect of pigment production, which was best observed on steamed rice, the cultures fall into three groups: (i) *F. orthoceras* var. *pisi*, producing blue or brown pigment, unaffected by the addition of hydrochloric acid or potassium hydroxide; (ii) *F. bostrycoides*, *F. orthoceras* and its varieties *apii* and *longuis*, *F. angustum*, and *F. lini*, producing a purple pigment, becoming red in hydrochloric acid and blue or violet in potassium hydroxide; and (iii) *F. conglutinans* and its varieties *betae* and *callistephi*, *F. orthoceras* var. *apii* f. 1, and the fungi causing gram wilt, none of which produce any pigment. The cultures varied greatly in the amount of aerial mycelium produced, but no specific relationship could be established. The production of aerial mycelium as well as of a stroma, and the size of non-septate spores are considered of no diagnostic value. Except in the case of *F. orthoceras* var. *apii* f. 1, the only effect of temperature on pigment production was a slightly more rapid appearance of colour and a tendency towards a slightly more violet hue at the higher temperatures. *F. orthoceras* var. *apii* f. 1 produced no pigment at 10°, 15°, 30°, and 35° C.; at 20° it produced a purple aerial mycelium and a dark plumbeous discoloration of the substrate, while at 25° one culture produced a slight patch of pigment at the top of the plant. In general, all cultures showed the greatest amount of aerial mycelium at 20°, 25°, and 30°, less being produced at 35° and very little at 10°. All cultures except *F. bostrycoides* had a thin plectenchymatous stroma, which in most cases was present at all temperatures except at 10°. The only culture showing a thin pionnotal layer of spores was that of *F. conglutinans* var. *callistephi*, which was placed by Wollenweber and Reinking in the group with pionnotes typically absent. Temperature had but little effect on the number of septations

or the length of conidia, but chlamydospore production was markedly better at 35° than at 20°. Variable results were obtained as to the influence of asparagine on septation or spore length in five strains tested.

It is concluded from the results of these studies that the key supplied by Wollenweber and Reinking for the identification of species of the *Orthocera* group is of no use with authentic cultures, since all of the major characteristics proved to be unstable. It is suggested that the original description of *F. orthoceras* covers *F. conglutinans* and its varieties *betae* and *callistephi*. The new combinations *F. orthoceras* App. & Wollr var. *conglutinans*, *F. orthoceras* App. & Wollr var. *betae*, and *F. orthoceras* App. & Wollr var. *callistephi* are, therefore, proposed for *F. conglutinans*, *F. conglutinans* var. *betae*, and *F. conglutinans* var. *callistephi*, respectively. The three fungi are stated to be morphologically indistinguishable from the fundamental species and to differ only in pathogenicity. The fungi causing wilt in gram are considered to comprise one variety, for which the name *F. orthoceras* App. & Wollr var. *ciceri* is proposed. According to the author's measurements the variation in spore size in *F. lini* is much greater than indicated by Wollenweber and Reinking, and their view that this species is a transitional form with other groups is not accepted. Some doubts are expressed with regard to the position of *F. angustum* which Wollenweber and Reinking had retained in the subsection *Orthocera* in spite of the shape and the length to breadth ratio of their spores which place them quite outside this group and rather point to the *Constrictum* subsection. *F. bostrycoides* was in no case observed to show the characteristic bostrycoid branching which gave it its name, but had a very distinct tendency to produce conidia in false heads. It is thought advisable to retain this species for the time being.

De Haan (I.) & Schoorel (A. F.). **Kaligebrek in de Theecultuur.** [Potash deficiency in Tea cultivation.]—*Arch. Theecult. Ned.-Ind.*, xiv, 2, pp. 43–81, 2 col. pl., 3 figs., 9 graphs, 1 map, 1940. [English summary.]

Tea bushes affected by potash deficiency, stated to be prevalent in west Java and along the west coast of Sumatra, may be recognized by the premature shedding of the leaves of the basal branches, towards the tips of which, however, foliar production continues on a reduced scale. The leaf margins are scorched and frequently invaded by various fungal blights, including *Pestalozzia theae*, these symptoms being sometimes preceded by the development of a dark bronze-green cast over the same area. The typical features of the disorder, as observed in the field, were artificially induced in tea seedlings grown in pot cultures in quartz sand with a synthetic nutrient solution from which potash was omitted, while leaf ash and soil analyses afforded further confirmation of the view that lack of available potash is at the root of the trouble on the affected estates. A close correlation was apparent between the external symptoms of potash shortage and the amount of the element present in the leaf ash, less than 10 per cent. potassium oxide usually accompanying severe damage while normal growth was made in the presence of upwards of 20 per cent. Soils with a potassium oxide content below

0·007 per cent. gave rise to deficiency symptoms while the beneficial effects of potash manuring (200 gm. potassium sulphate per sq. m.) were experienced in those with up to 0·017 per cent.; the disappearance of the abnormal symptoms under this treatment was accompanied by an increase in leaf production, as well as in the potassium oxide content of the foliage.

SCHOOREL (A. F.). **Kaligebrek in de Theecultuur II.** [Potash deficiency in Tea cultivation II.]—*Bergcultures*, xiv, 42, pp. 1336–1339, 2 graphs, 1940.

Further information is presented concerning the pathological condition of tea plantations situated on potash-deficient soils in Java and Sumatra [see preceding abstract], most of those in the former region being of the reddish- to yellowish-brown, very permeable, weathered andesite-tufa-laterite types, and in the latter volcanic pseudo-sand. Small applications of potash were of little benefit in the correction of the trouble, an annual dose of 15 to 25 gm. potassium sulphate per plant being regarded as essential to maintain the gardens in a satisfactory state of health where incipient signs of shortage have been observed. Drastic pruning is poorly tolerated by bushes suffering from lack of potash, and the shoots should not be cut back to a length exceeding 60 cm. during the period of rehabilitation; in one test the incidence of mortality among bushes pruned back to distances of 40, 60, 80, and 100 cm. was 0, 0·3, 2·3, and 16 per cent., respectively. Increased leaf production of 45, 19, and 61 per cent. above the control resulted from the experimental application of three potash-containing fertilizers.

PFÄLTZER (A.). **Een voorloopige mededeeling over de zgn. 'bitten-off disease', een ziekte bij Theekweekplanten.** [A preliminary note on the so-called 'bitten-off disease', a disease of nursery Tea plants.] —*Bergcultures*, xiv, 43, pp. 1364–1365, 1 fig., 1940.

From the rootlets of tea seedlings showing 'bitten-off' symptoms [*R.A.M.*, xix, p. 677] at the Malang and West Java Experiment Stations, as well as from similar material in the Tjibadak district and east Java, a species of *Pythium*, as yet undetermined, has been isolated and proved by inoculation experiments to be a virulent parasite, especially on unsterilized soil. The soil used for these tests was rather less acid ($P_H$ 6·65) than Gadd's optimum for the growth of tea ($P_H$ 5·3 to 6·5), but yielded vigorous seedlings, and no evidence was obtained that insufficient acidity is the primary factor in the development of the 'bitten-off' condition.

LAUFFER (M. A.) & STANLEY (W. M.). **Die Kolloidchemie des Tabakmosaikvirus.** [The colloid chemistry of the Tobacco mosaic virus.] —*Kolloidzschr.*, xci, 1, pp. 62–70, 1 fig., 2 diags., 7 graphs, 1940.

Recent outstanding contributions to the knowledge of the tobacco mosaic virus are summarized with emphasis on its utility as an adjunct to the solution of colloid-chemical problems.

VALLEAU (W. D.). **Classification and nomenclature of Tobacco viruses.** —*Phytopathology*, xxx, 10, pp. 820–830, 1940.

This is a discussion of the eight viruses causing disease in commercial tobacco plantings in Kentucky, viz., tobacco mosaic, etch, cucumber mosaic, tobacco streak, veinbanding, tobacco ring spot, tomato spotted wilt, and tobacco leaf curl, of which the first four are regarded as unrelated to any others and are accordingly transferred to the new genera *Musivum*, *Foliopellis*, *Murialba*, and *Tractus* as *Musivum tabaci* n. comb., *F. erodens* n. comb., *Murialba cucumeris* n. comb., and *T. orae* n. comb., respectively. For the tobacco ring spot virus (*Annulus tabaci* Holmes) the author thinks it would be preferable to use the laboratory name and disregard the latinized name, and he rejects the family Annulaceae [*R.A.M.*, xviii, p. 607] as based on a spurious recovery. The veinbanding virus is raised to specific rank as *Murialba venataenia* n.sp. (*Marmor cucumeris* var. *upsilon* Holmes).

Of the three proposed systems of virus nomenclature, viz., J. Johnson's [ibid., vi, p. 501], K. M. Smith's [ibid., xvii, p. 52], and Holmes's, the last-named is preferred, though with certain reservations, and adopted wherever possible. The relative merits of the serological and immunity reaction (protective) methods of virus classification are discussed.

HEAN (Miss A. F.). **Kromnek in South Africa. Its host range and distribution.**—*Fmg S. Afr.*, xv, 175, pp. 388–390, 3 figs., 1940.

In this account of the host range and geographical distribution of 'kromnek' disease [*R.A.M.*, xix, p. 196] in South Africa, the author states that cos lettuce has not so far been found naturally infected, even when growing between two severely affected tomato plantings, and only with great difficulty has it been artificially infected. Sweet peas and other leguminous plants growing next to diseased tomatoes have never been observed to be affected. All attempts to infect petunias systemically gave negative results.

A virus disease which from its properties and host range appears to be closely related to kromnek is fairly common in the vicinity of Pretoria, and may be present in the Kat River area of Cape Province. The chief host is the petunia, to which this disease is readily transmitted by the usual methods, systemic infection becoming apparent shortly after inoculation. With kromnek, on the other hand, only small, brown necrotic spots are obtained on inoculated petunia leaves, and in no instance was petunia observed to show these spots naturally.

Tomato varieties resistant to spotted wilt in California showed no greater resistance to kromnek in South Africa than did the ordinary commercial varieties commonly grown in the latter country. *Lycopersicum pimpinellifolium* developed 20 per cent. natural infection when planted out in Pretoria.

A type of tobacco resistant to a virus disease found in South America and apparently closely related to spotted wilt was ascertained to be as susceptible to kromnek as the ordinary commercial varieties. The plants died off completely a few days after the symptoms had appeared.

As many hosts of kromnek are perennials or vegetatively propagated,

e.g., dahlias, *Stapelia* spp., *Erlangea tomentosa* (imported from East Africa), and *Medicago* sp., a reservoir of infected plants is always present from which the disease may be spread in summer.

The paper terminates with an annotated list of the known hosts of kromnek and a list of the localities affected in South Africa.

Grooshevoy (S. E.), Khudyna (I. P.), & Popova (Mme A. A.). Термический метод обеззараживания семян Табака и Махорки. [Thermal method for disinfecting Tobacco and Indian Tobacco seeds.]—*Всесоюзн. научноисслед. Инст. Табачн. Махорочн. Пром. им. А. И. Микояна* (*ВИТИМ*). [*The A. I. Mikoyan pan-Soviet sci. Res. Inst. Tob. and Indian Tob. Ind.* (*VITIM*)], *Rostoff-on-Don, Publ.* 141, pp. 3–29, 1940. [English summary.]

In the course of seed disinfection experiments carried out during the years 1935 to 1939 [*R.A.M.*, xvii, p. 711], the best results were obtained by heating the seeds (packed in 0·5 or 1 kg. sacks) for one hour at 85° to 90° C. after drying them, preferably at 40° to 42° for two to four days, so that their moisture content is reduced to less than 6 per cent. No improvement resulted from heating at 100° for the same period or at 80° for five hours. In seeds treated by this thermal method infection by *Fusarium* sp. and *Botrytis cinerea* was completely controlled. The incidence of *Bacterium tabacum* in tobacco and Indian tobacco [*Nicotiana rustica*] plants grown from treated seeds was, on the average, 3·7 and 5·8 per cent., respectively, as compared with 6·9 and 10 per cent. in the untreated controls. It was experimentally found that the thermal method was twice as effective in controlling *Bact. tabacum* as treatment with silver nitrate (1: 1000) or formalin (1: 50). The authors also claim that the thermal method reduces by half the incidence of various seed-borne virus diseases. The germinability of seed stored after harvest for one to two years was not impaired by subsequent drying or heating; of the seeds stored for longer periods some, particularly variety Dubeck 44, suffered through heating, while others did not lose their germinability even after three years' storage. It is advised, therefore, before applying the thermal method to older seeds, to test a small quantity of them for their reaction to heating.

In farm experiments it was shown that an average increase in yield of 15·6 per cent. for tobacco and 13·4 per cent. for Indian tobacco resulted from the use of heated seeds.

Grooshevoy (S. E.), Levykh (P. M.), Roozinoff (P. G.), & Nicolayeva (Mme R. G.). Химический метод обеззараживания парникового субстрата. [Chemical method of disinfecting seed-bed soil.]—ibid., pp. 30–41, 1940. [English summary.]

The results of experiments carried out during 1937 to 1939 in the Crimea and in Krasnodar show that the application of chloropicrin [see below, p. 93] to tobacco seed-bed soil at the rate of 0·5 l. per cu.m. of soil reduced the percentage of seedlings infected with *Thielaviopsis basicola* [see next abstracts] from 89·0 to 1·5, and at rates of 0·75 or 1 l. per cu.m. the disease was completely controlled. Applying

chloropicrin to moderately moist soil (of about 60 per cent. saturation) at a temperature of above 15° C. was more satisfactory than applying it to either moister or drier soil at lower temperatures. The best method, and the least dangerous to men and animals in the vicinity, consisted in adding chloropicrin to the compost placed in pits (which can be covered up) at the rate of 0·5 l. per cu.m., preferably in autumn in sufficiently warm weather. The application of chloropicrin also considerably reduced the growth of various weeds, but was in that respect not as effective as thermal treatment of seed-bed soil [*R.A.M.*, xv, p. 751].

GROOSHEVOY (S. E.) & LEVYKH (P. M.). Возможность получения незараженной парниковой смеси в компостных кучах. [The possibility of obtaining seed-bed soil free from infection in compost heaps.]—ibid., pp. 42–48, 1940. [English summary.]

This is a preliminary account of experiments carried out during 1939, in which it was found that compost heaps of various compositions prepared for tobacco seed-beds [cf. preceding and next abstracts] developed in all but their outer layer (of 10 cm. thickness) temperatures, varying from 49° to 63° C., which were lethal to spores of *Thielaviopsis basicola*, pseudosclerotia of *Rhizoctonia* sp., seeds of various weeds, and to the virus of tobacco mosaic [but see *R.A.M.*, xiii, p. 188]. It is, therefore, considered possible, by adjusting the composition of the heaps and by improving the method of composting generally, to obtain seed-bed soil completely free from the agents of the main diseases of tobacco.

GROOSHEVOY (S. E.), LEVYKH (P. M.), & MALBIEVA (Mme E. I.). Режим обеззараживания парниковой смеси даровыми источниками тепла. [Methods of disinfecting seed-bed soil by natural sources of heat.]—ibid., pp. 49–61, 1940. [English summary.]

In further experiments on the disinfection of tobacco seed-bed soil [see preceding abstracts] conducted during 1939 and 1940, it was shown in laboratory tests that chlamydospores of *Thielaviopsis basicola* fail to germinate after being heated at constant temperatures of 40°, 45°, 50° to 55°, 60°, 65°, 70°, and 75° C. for 115, 48, 24, 6, 5, 4, and 1½ hours, respectively, or after being heated three hours a day at 45° during 5 days or at 50° during 3 days. The pseudosclerotia of *Rhizoctonia* sp. failed to germinate after being heated at 45°, 50°, 55°, and 60° for 48, 10, 8 hours, and ½ hour, respectively, or for three hours a day at 45° during 3 days. The sclerotia of *Sclerotinia libertiana* [*S. sclerotiorum*] failed to germinate after being heated at 45° and 50° to 55° for 36 hours and 1 hour, respectively, or for three hours a day at 45° during 3 days. It is concluded from these results that the temperatures developing within compost heaps and solar energy directed on seed-bed soil in cold frames [*R.A.M.*, xviii, p. 635] can ensure freedom from spores of the chief causal agents of tobacco diseases, provided, in the first case, a temperature of not less than 45° obtains in the heap for five days, or, in the second case, the soil in the cold frame is heated

by the sun during the hottest hours of the day to from 45° to 50° for the same period. Higher temperatures or longer exposures are necessary to ensure the destruction of most weed seeds.

Grooshevoy (S. E.) & Popova (Mme A. A.). Протравливание корней рассады перед посадкой как мера борьбы с болезнями Табака и Махорки. [Treatment of seedling roots before transplanting in the control of Tobacco and Indian Tobacco diseases.]—ibid., pp. 62–77, 1940. [English summary.]

In further experiments on the control of tobacco diseases [*R.A.M.*, xviii, p. 635] in which various chemicals were tested on a number of farms from 1937 to 1939, the best results were obtained by dipping the roots of tobacco and Indian tobacco (*Nicotiana rustica*) seedlings before replanting in 1 per cent. Bordeaux mixture. In tobacco, the incidence of bacterial 'ryaboukha' (*Bacterium tabacum*) was almost completely controlled (the infection ranging from 0·8 to 50 per cent. in the untreated control, and from 0 to 2·7 per cent. in the treated lots), that of black root rot (*Thielaviopsis basicola*) [see preceding abstracts] reduced on the average 2·4 times (from 0·6 to 63·2 per cent. in the untreated control to 0·05 to 38·1 per cent. in the treated lots), that of tobacco mosaic 4 to 5 times (from 1·4 to 42 per cent. in the untreated control to 0 to 10·8 per cent. in the treated lots), and that of *Phyllosticta* [ibid., x, p. 628] from 2·1 per cent. in the untreated control to 0·3 per cent. in the treated lots. In Indian tobacco, the incidence of *Bact. tabacum* was reduced from 3·0 to 63·5 per cent. in the untreated control to 0 to 36 per cent. in the treated lots), and that of ring spot (virus) 1·6 times (from 3 to 68 per cent. in the untreated control to 0 to 48·5 per cent. in the treated lots). In regions of sufficient moisture, the dipping of seedling roots in disinfectant had no harmful effect on the subsequent development of tobacco and Indian tobacco plants in the field and sometimes even improved the yields, particularly when the seedlings were treated at the stage of normal maturity; in dry regions, however, the treatment resulted in thinner stands, especially if the seedlings were treated when too small or over-mature. The treatment is therefore recommended only for the wet zone or for low-lying, moist areas in the dry one.

Popova (Mme A. A.). Влияние удобрений на поражаемость Махорки бактерияльной рябухой и заразихой. [The effect of fertilizers on the infection of Indian Tobacco with wildfire and Broomrape.]—ibid., pp. 158–175, 1940. [English summary.]

According to a survey completed in 1938, bacterial 'ryaboukha', referred to by the author as wildfire [*Bacterium tabacum*: see preceding and next abstracts] is the most prevalent disease of Indian tobacco (*Nicotiana rustica*) in the Ukraine, infecting 62·7 per cent. of the inspected area and occurring usually in a severe or moderately severe form. In field trials conducted from 1936 to 1938, it was found that the application of potassium and nitrogen fertilizers to the soil generally reduced the amount of wildfire in *N. rustica* whereas dressings of phosphate often increased it. While the application of a combined nitrogen-potassium fertilizer reduced the percentage of infected plants

from 48·7 in the untreated plots to 9·7, the addition of phosphate in various forms to that fertilizer resulted in much less satisfactory control. The best results in controlling wildfire as well as *Orobanche ramosa* were obtained by applying the complete nitrogen-phosphorus-potash fertilizer in the autumn in the proportions 300 : 100 : 200, which reduced the percentage of infected plants from 7 in the untreated control to 0 and increased the average plant weight from 93·3 to 327·1 gm.; and 600 : 180 : 300, reducing the percentage of infected plants from 14 to 0·5 and increasing the average plant weight from 99·2 to 195·6 gm.

Popova (Mme A. A.). Приемы агротехники в борьбе с бактерияльной рябухой Махорки. [Agrotechnical methods in the control of wildfire of Indian Tobacco.]—ibid., pp. 176–195, 1940. [English summary.]

The following agricultural practices were found from 1932 to 1938 to exert an effect on the incidence of bacterial 'ryaboukha' or wildfire [*Bacterium tabacum*: see preceding abstracts] on Indian tobacco (*Nicotiana rustica*). Plants sown directly in the field were usually more affected (1·4 to 5·2 per cent.) than those transplanted from the seed-bed (1·0 to 3·4 per cent.), except in isolated years with a particularly early outbreak of wildfire, when the case may be reversed. Early planted Indian tobacco showed less infection (31·2 to 33·2 per cent.) than late planted (40·1 to 50·8 per cent.), the same difference being observed between the early and late dates of sowing (3·0 to 22·5 as compared with 5 to 35 per cent.). A reduction in the amount of the disease from 53·2 to 12·2 per cent. was obtained by loosening the soil between the rows every six days as compared with control plots in which weeds were cut down without disturbing the soil. With plants sown directly in the field, thinning out in the phase of the fourth to sixth leaf resulted in less disease than when postponed to later dates. Planting of protective rows decreased the amount of infection from 30 in the unprotected plants to between 5·3 and 12·5 per cent. Growers are advised to plant such protective rows to the windward, and to use plants taller than Indian tobacco. Indian tobacco cultivated on the same field for two to three years in succession suffered more from wildfire than when grown in rotation, particularly with leguminous crops.

Grooshevoy (S. E.) & Levykh (P. M.). Химический метод борьбы с мучнистой росой Табака. [Chemical method of controlling powdery mildew of Tobacco.]—ibid., pp. 78–97, 1940. [English summary.]

Powdery mildew of tobacco [*Erysiphe cichoracearum*: *R.A.M.*, xvi, p. 214] is stated to cause usually considerable losses in the tobacco-growing districts of Russian Central Asia, and occasionally in the Crimea, Abkhazia, Black Sea littoral, Krasnodar, and Transcaucasia. In field trials of fungicides for the control of this disease carried out in 1938–9, the highest yields and generally best results were obtained by spraying tobacco plants with lime-sulphur (20 per cent. Baumé) at a concentration of 1 in 100. The spraying impaired the smoking quality of tobacco somewhat, but to a less degree than did the powdery mildew.

Levykh (P. M.). Влияние температуры и влажности воздуха на поражаемость Табака мучнистой росой (**Oidium tabaci Thuem.**). [The influence of temperature and air humidity on the infection of Tobacco by powdery mildew (*Oidium tabaci* Thuem.).]—ibid., pp. 97–111, 1940. [English summary.]

The oidia of *Oidium tabaci* [*Erysiphe cichoracearum*: see preceding abstract] were found to germinate readily when, in the course of experiments in 1938–9, they were placed on dry slides in a moist chamber, but not in drops of water. The optimal temperature for germination was 11° to 25° C., none occurring at 1·9° to 4·8° or at 41°. Under optimal temperature conditions germination was best at relative air humidities from 60 to 100 per cent. The optimal conditions for the infection of tobacco plants with *E. cichoracearum* obtained at a relative air humidity of 60 to 75 per cent. at temperatures between 16° and 23·6°, the minimum being 10° and the maximum 26·2°. Under natural conditions, however, infection occurs even when the day temperature rises above 26·2° provided that the optimal range (18° to 19°) obtains by night. Inoculated tobacco plants exposed to an air humidity of 100 per cent. and optimal temperatures showed no external signs of infection after six days, but the symptoms developed and the oidia appeared when the air humidity was lowered to 70 to 76 per cent. The oidia quickly lost their germinability in storage, the loss of virulence being most rapid at 19° to 21° and at an air humidity of 40 to 58 per cent., and slowest at 14°. Only those oidia stored at an air humidity of 80 to 89 per cent. survived for 12 days.

Khudyna (I. P.). Отношение сортов **Nicotiana tabacum L.** и некоторых видов **Nicotiana** к заражению вирусом Табачной мозаики (**Nicotiana virus 1 (Mayer) Allard**). [The reaction of some *Nicotiana tabacum* L. varieties and some *Nicotiana* species to infection with Tobacco mosaic virus (*Nicotiana* virus 1 (Mayer) Allard).]—ibid., pp. 112–124, 1940. [English summary.]

None of the 711 varieties of tobacco belonging to different genetic groups tested in varietal trials from 1933 to 1939 showed resistance to the virus of tobacco mosaic, although they exhibited considerable differences in the degree of malformation and the character of mottling. The variety Ambalema received from Nolla and Valleau [*R.A.M.*, xvii, p. 417] was found to be highly resistant to three strains of the virus (severe, yellow, and mild). Of the other species of *Nicotiana* tested, *N. glutinosa* completely localized the virus in primary necrotic lesions; *N. rustica*, *N. langsdorffii*, *N. alata*, *N. sanderae* and others showed necrotic spots on infected leaves followed by systemic infection leading often to death of the plant; systemic infection with mottling was exhibited by *N. sylvestris*, *N. acutifolia*, *N. longiflora*, and *N. glauca*; and a prolonged yellowing by *N. quadrivalvis*.

The variety Ambalema and *N. glutinosa* are considered as promising for future breeding work, the object of which should be to select tobacco varieties with an ability to localize the virus.

FOISTER (C. E.). **Descriptions of new fungi causing economic diseases in Scotland.**—*Trans. bot. Soc. Edinb.*, xxxiii, 1, pp. 65–68, 14 figs., 1940.

Technical diagnoses in Latin and English are given of two new fungi causing economic diseases in Scotland, viz., *Phytophthora verrucosa* Alcock & Foister n.sp., causing tomato toe rot [*R.A.M.*, xv, p. 614] and *Phoma foveata* Foister n.sp., causing potato gangrene [ibid., xix, p. 614].

The former is characterized by inversely piriform or oval, terminal or lateral, non-papillate sporangia measuring 31 to 56 by 24 to 36 (average 41·5 to 29·5) $\mu$, with a broadly rounded, slightly thickened hyaline apex and no pedicel, borne on undifferentiated sporangiophores, 15 to 250 $\mu$ long. Germination is effected by means of zoospores. Further sporangia are produced usually within, rarely beyond, an empty one by renewed sporangiophore growth. The terminal, rarely lateral, spherical oogonia measure 23 to 47 (average 37) $\mu$ in diameter, and usually show a wall 1·7 to 7·7 (4·7) $\mu$ thick. The terminal, seldom lateral, antheridia measure 11 to 22 by 10 to 17 (average 16 by 13) $\mu$ when paragynous, and 9 to 22 by 8 to 20 (17 by 15) $\mu$ when amphigynous. The spherical, hyaline oospores turn light golden-brown with age, measure 17 to 31 (average 24) $\mu$ in diameter, and have a wall 3 $\mu$ thick. The fungus is parasitic on the roots of cultivated tomato and *Meconopsis* spp.

*Phoma foveata* shows numerous, isolated or gregarious, subcoriaceous, totally immersed to partially erumpent, irregularly-shaped but mostly globose pycnidia measuring 105 to 309 by 110 to 418 (average 177 by 187) $\mu$, with beak and ostiole absent or indistinct, and with a very solid, dark brown wall with a lining of thin hyaline cells. Commonly situated in pseudo-subicular sheets, the pycnidia are often superimposed, rarely compound. The oblong or ovoid, hyaline, continuous, very rarely bi- to tricellular pycnospores measure 3·2 to 7·7 by 1·1 to 2·1 (average 5·7 by 1·7) $\mu$, are singly borne on simple, very short sporophores, yellow-cream in the mass, and extruded from the pycnidia as globules. Dark brown chlamydospores also occur in chains. The fungus is reported from Great Britain and Northern Ireland. It differs in culture from *P. eupyrena*, *P. solanicola*, and *Phomopsis tuberivora*.

WELLMAN (F. L.) & BLAISDELL (DOROTHY J.). **Differences in growth characters and pathogenicity of Fusarium wilt isolations tested on three Tomato varieties.**—*Tech. Bull. U.S. Dep. Agric.* 705, 28 pp., 2 figs., 5 graphs, 1940.

Out of 127 cultures isolated from wilt-diseased tomatoes in various parts of the United States, 30 were selected for studies on the pathogenicity of the fungus, and of these 29 were definitely identified by Reinking as *Fusarium bulbigenum* var. *lycopersici*, one belonging to another species of the same genus. The organisms were grown on prune, malt, starch, and ordinary and acidified potato dextrose agars, and on Brown's, Leonian's, Richards's modified, soil extract, and Tochinai's [*R.A.M.*, xix, p. 170] liquid media and fell into five distinct cultural groups varying noticeably in their effects on the three tomatoes used in the tests, Red Currant (*Lycopersicum pimpinellifolium*), Marglobe,

and Bonny Best. The most virulent cultures were those with a raised, white mycelium, sometimes flecked with light vinaceous-purple, closely followed by those of a similar colour forming sclerotium-like bodies; a fair amount of infection was produced by the pale vinaceous-grey, intermediate-raised type; the pathogenicity of intermediate-appressed cultures with sparse mycelium over a vinaceous-purple, appressed growth was weaker than the foregoing, while the least injurious were the completely appressed, light vinaceous-grey to slate-purple cultures with no aerial mycelium. Saltation took place in all the classes, being most conspicuous in the raised sclerotial, least so in the fully raised and completely appressed, and intermediate in the transitional groups. The saltants were generally less virulent than the parent cultures.

The fully raised group of cultures produced an average disease evaluation [loc. cit.] on the highly susceptible Bonny Best of 10·39, denoting irreversible injury, the corresponding figures for the raised sclerotial, intermediate-raised, intermediate-appressed, and completely appressed categories being 8·67, 8·34, 6·31, and 4·69, respectively, expressing damage of progressively diminishing intensity. The tolerant Marglobe suffered severe injury from the most virulent cultures (7·50 and 6·25 raised and raised sclerotial, respectively), but proved distinctly resistant to the less pathogenic, while the resistant Red Currant was scarcely affected except by the raised group, and then only mildly (1·42).

Mills (W. R.). **Phytophthora infestans on Tomato.**—*Phytopathology*, xxx, 10, pp. 830–839, 1940.

Tomato foliage is normally resistant to the potato strain of *Phytophthora infestans* [*R.A.M.*, xvii, p. 621], six or seven passages of which from the Green Mountain variety, however, through Bonny Best tomato leaves at the Cornell Agricultural Experiment Station, New York, increased the virulence of the fungus to such an extent that it readily killed tomato plants (Bonny Best, San Mazzano, Allred, and Red Pear). No further access of virulence resulted from additional passages (up to 22) through tomato foliage. A culture of the fungus highly pathogenic to certain potato hybrids [ibid., xvii, p. 482] induced the typical potato strain reactions on tomato foliage prior to seven passages through the latter, after which its virulence towards tomato equalled that of the tomato strain without any loss of infectivity on potato.

Potato leaves were attacked with equal severity by the strains from both hosts, that from tomato retaining its pathogenicity for the original host after three and six months' growth on potato foliage and tubers, respectively. Both strains produced sporangia of equal size on potato leaves and tubers, but the potato strain formed smaller ones than that from tomatoes on tomato foliage, the following dimensions of length having been calculated: strain from potato tuber on potato and tomato, $29{\cdot}34 \pm 0{\cdot}34$ and $29{\cdot}08 \pm 0{\cdot}52\ \mu$, respectively; from potato leaves, $26{\cdot}60 \pm 0{\cdot}39$ and $26{\cdot}14 \pm 0{\cdot}35\mu$, respectively; from tomato leaves, $24{\cdot}46 \pm 0{\cdot}44$ and $26{\cdot}35 \pm 0{\cdot}40\ \mu$, respectively.

It is concluded from these observations that the tomato strain arises

in nature as a sequel to the serial passage of the potato strain through tomato leaves.

WARD (A. H. O.). **Sleeping disease of Tomatoes.**—*Gdnrs' Chron.*, cvii, 2787, pp. 260–261, 1940.

The writer reports the complete recovery from 'sleepy disease' (*Verticillium*) [*albo-atrum*] in June, 1939, of 22 out of 24 tomato plants in Guernsey, where the disease is very prevalent [cf. *R.A.M.*, xv, p. 690], as a result of transference from the affected glasshouse to pots filled with humus prepared according to the Indore process in a cold house. In March, 1940, five out of six diseased plants similarly treated also recovered.

YOUNG (P. A.). **Soil fumigation with chloropicrin and carbon bisulphide to control Tomato root knot and wilt.**—*Phytopathology*, xxx, 10, pp. 860–865, 1940.

Effective control of tomato wilt (*Fusarium* [*bulbigenum* var.] *lycopersici*) in the very susceptible Greater Baltimore, Stone, and Earliana varieties was obtained at the Texas Agricultural Experiment Station by the application to the soil of chloropicrin [*R.A.M.*, xix, p. 611] at 300 to 600 lb. per acre, which reduced the average incidence of infection from 95 to 9 per cent. Carbon disulphide proved ineffectual for the object in view. Fumigation with chloropicrin at the rate of 10 c.c. per cu. ft. was also efficacious against damping-off fungi (*Pythium* and *Rhizoctonia* spp. [including *Corticium solani*]) in heavily (nearly 100 per cent.) infested soil. Animal glue, casein, and vegetable paste all served equally well as coatings for the paper used for covering treated soil to delay the escape of the fumigants, while practically the same results were secured by wetting the top 2 or 3 in. of the soil with water.

DANA (B. F.). **Occurrence of big bud of Tomato in the Pacific Northwest.**—*Phytopathology*, xxx, 10, pp. 866–869, 3 figs., 1940.

Big bud of tomato [*R.A.M.*, xv, p. 406], a disorder apparently new to the North American continent, developed very sparsely in the Pacific North-west from 1937 to 1939, inclusive, affecting the Marglobe, Dwarf Champion, and Bonny Best varieties and miscellaneous lots of *Lycopersicum* spp. from South America. The branches were abnormally numerous and clumped into witches' brooms, which bore misshapen inflorescences with increased subdivisions and phylloid flowers. Phloem proliferation was consistently associated with these anomalies. Premature and uneven ripening, woodiness of the placental tissue, and poor flavour of the fruit were characteristic of diseased Marglobes in one locality. The disease was transmitted from infected to healthy plants by bud-grafting, but not by means of the juice, with an incubation period of a month. At the same time, phyllody and aggregation of branches occurred on common and Lima beans [*Phaseolus vulgaris* and *P. lunatus*], soy-bean [cf. ibid., xvii, p. 223], lucerne [loc. cit.], sweet clover [*Melilotus*], squash, and carrot, suggesting a possible connexion between big bud of tomato and the similar disturbances of these hosts. In 1937 and 1938 big bud and curly top occurred contiguously in the field, but in 1939 the former was present and the latter

absent. Big bud tends to stimulate vegetative growth and curly top to depress it, besides causing tissue necrosis. Macroscopic symptoms are usually sufficient to differentiate the two diseases; but confirmatory histological comparisons of phloem development are recommended.

HOFFMAN (C. H.) & MOSES (C. S.). **Mating habits of Scolytus multistriatus and the dissemination of Ceratostomella ulmi.**—*J. econ. Ent.*, xxxiii, 5, pp. 818–819, 1940.

Experimental evidence is briefly adduced to show that a single male of *Scolytus multistriatus* contaminated with *Ceratostomella ulmi* [*R.A.M.*, xix, p. 680] may distribute the fungus to several brood burrows on entering them to mate with the females. Of 208 brood burrows containing larvae, 165 (79 per cent.) yielded the pathogen as against only 20 (25 per cent.) of those without them. In these tests the males furnished the sole source of inoculum.

BUCHANAN (W. D.). **Ambrosia beetle, Xylosandrus germanus, transmits Dutch Elm disease under controlled conditions.**—*J. econ. Ent.*, xxxiii, 5, pp. 819–820, 1940.

The ambrosia beetle, *Xylosandrus germanus*, was observed in the field to penetrate into elm logs, felled trees, exposed roots, stumps, and chemically killed trees harbouring the elm disease fungus (*Ceratostomella ulmi*) [see preceding abstract], as well as into similar material free from the pathogen. In 1936, 2 out of 826 (0·24 per cent.) adults collected from the surface of elm trap trees in New Jersey were found to have thus acquired accidental contamination, and experiments were therefore undertaken to determine whether *C. ulmi* could be transmitted by the beetles to healthy logs and trees under favourable conditions. In one test the insects were allowed to migrate freely from a battery jar containing infected elm sections to another occupied by similar healthy material, from which chips were subsequently cultured, the organism being found in 16 out of 94 (17 per cent.), as well as in 3 out of 31 (9·6 per cent.) of the beetles removed directly from the diseased sections into which they had bored. In another experiment the beetles, after being contaminated by *C. ulmi*, were liberated on six healthy five-year-old elm trees (250 per tree), enclosed in muslin cages. The insects made an average of 11·3 holes per tree (all in the trunks), and *C. ulmi* was isolated from five of the trees, only one of which, however, developed the typical symptoms of the disease.

METCALFE (G.). **The watermark disease of Willows. I. Host-parasite relationships.**—*New Phytol.*, xxxix, 3, pp. 322–332, 1 pl., 2 diags., 1940.

In the course of studies at Cambridge, the stained area of a cut two-year-old branch of the cricket-bat willow (*Salix coerulea*), recently affected by the watermark disease [*R.A.M.*, xix, p. 486], was found to consist of three distinct regions, viz., a narrow, black outer zone extending irregularly round the annual ring; a red-brown, waterlogged area between this and the initial parenchyma; and a dark brownish-green, sodden inner zone involving the whole of the wood (with the pith). On exposure to the air the cut surface first turns a bright red-

brown (almost scarlet) and then black. On cutting a thin section from a diseased branch the colours immediately change, the black-stained ring appearing brown and the rest of the affected wood lighter. The black appearance is an optical effect, and there is no real black staining. In branches exceeding 3 in. in diameter the dark ring may be replaced by a circle of discrete patches, or it may take the form of an arc. Branches diseased for over a year may show two or more dark rings or a discoloured centre surrounded by a dark ring.

The bacterial population of the watermarked wood was found to change with time, *Bacterium salicis* being replaced after the first year by three associated organisms, designated A, B, and C, which ultimately permeate all the tissues and completely occlude the vessels, and there is extensive formation by tyloses. The pathological histology of the invaded wood (young and older branches and roots) is fully described, the appearance of the latter resembling that of the shoots.

Infection of the outer elements of the new annual ring takes place in the late summer by way of the holes bored by insect larvae, but inoculation experiments showed that there is no active spread of the organisms between May and September. Following the hydrolysis of starch in March and the consequent appearance of high concentrations of food materials in the sap, the bacteria become actively motile and multiplication is so rapidly effected that within a month a new disease zone has been formed throughout the tree, both above and below ground, the vessels being blocked and oil accumulating in the ray cells, which are impregnated with a brown stain. From May onwards there is a progressive re-invasion of the wood of the innermost diseased annual ring by secondary bacteria, probably originating in the roots: at this stage *Cytospora chrysosperma* gains ingress to the wood and rapidly extends as the branch dies. Early in the summer, therefore, a two-year-old branch that has been diseased for one year begins to assume the typical January aspect of a branch infected for two years, and by the end of August this transition is almost complete. At this time, however, the current year's wood seems to be free from bacteria, a thin wall-layer of which only becomes noticeable in the outermost vessels in the autumn.

The small cracks formed by the solution of the middle lamellae of the walls in the disease zone are attributed to the pectin-utilizing properties (experimentally demonstrated) of bacterium C, which enters by way of the pit membranes. During their spread along the middle lamellae, the organisms come into contact with healthy vessels and ray cells, which in turn are colonized. By means of this tangential diffusion within an annual ring, the bacteria are able to penetrate the wood connected with branches the point of insertion of which lies above or below that of the original site of attack.

Luttrell (E. S.). **Morenoella quercina, cause of leaf spot of Oaks.**—*Mycologia*, xxxii, 5, pp. 652–666, 13 figs., 1940.

A leaf spot of oaks caused by *Morenoella quercina* is widely present throughout the south-eastern area of the United States. In the Duke Forest the condition affects the red oaks *Quercus borealis* var. *maxima*,

*Q. velutina*, *Q. marilandica*, *Q. coccinea*, *Q. rubra*, and *Q. phellos*, though the white oaks *Q. alba* and *Q. stellata* appear to be immune. In other localities the disease occurs on *Q. rubra*, *Q. pumila*, *Q. myrtifolia*, and also on the white oaks *Q. geminata*, *Q. virginiana*, *Q. virens*, *Q. minima*, *Q. chapmani*, and *Q. stellata*.

The disease is most apparent on young trees, on the leaves of which small, blackened areas appear in early summer, somewhat resembling injuries caused by sucking insects. Characteristic mycelium is, however, present on the upper leaf surface. In September, the spots increase in size to a centimetre or more in diameter. Circular and purplish-black on the upper surface, they appear as irregular, brownish areas on the lower. They may become confluent and cover most of the leaf surface. Affected leaves do not fall prematurely, but photosynthesis is impaired, and severe infection over a period of several seasons reduces the vitality of seedlings. The condition is not of appreciable importance on older trees.

The nomenclature of the causal organism is briefly reviewed and the name *M. quercina* (Ellis and Martin) Theissen accepted; the fungus is regarded as belonging to the group Ascoloculares, as delimited by Nannfeldt [*R.A.M.*, xi, p. 606]. It is a superficial parasite depending in its early development on nutrients absorbed through the intact host cuticle. The hyphae subsequently penetrate the cuticle to form a subcuticular mycelium. The external mycelium may produce toruloid hyphal fragments functioning as conidia. A spermogonial stage, not hitherto recorded, is described. When mature the spermogonium is hemispherical with a basal wall lacking, the floor being occupied with a layer of large hyaline spermatiophores. Each cell is ampulliform and abstricts hyaline spermatia, 6·4 by 1·3 $\mu$. Spermogonia and ascocarp initials appear concurrently on the same external mycelium before the leaves are shed, the ascocarps continuing to develop on the fallen leaves and reaching maturity in spring. The ascocarp is a flat stroma consisting of a pseudoparenchymatous, radiate shield arising from a segment of a single hypha, and of a plectenchymatous fertile layer under the shield. The asci arise singly within the stroma, the intervening sterile tissue becoming absorbed, and the covering shield splitting to expose the mature asci. These are short, cylindrical, and broadly rounded at the apex, about 27 by 10 $\mu$, and contain bicellular, ultimately dark brown ascospores, 12 to 14 by 5 to 6 $\mu$.

HATTORI (T.) & TAMURA (T.). **The effect of electric current on the growth of fungi.**—*Electrotech. J.*, *Tokyo*, iv, 3, pp. 58–63, 3 figs., 4 diags., 1940.

Most of the information contained in this detailed description of the writers' experiments on the effect of electric currents on fungal growth, the object of which was to devise a method of prolonging the life of timber on the Imperial (Japanese) Government Railways, has already been noticed from another source [*R.A.M.*, xix, p. 379], but it may be of interest to mention that the woods used for the tests were *Pinus densiflora* (for *Poria vaporaria*) and *Fagus sieboldii* for *Schizophyllum commune* and *Polystictus sanguineus*.

IMPERIAL MYCOLOGICAL INSTITUTE

# REVIEW
OF
# APPLIED MYCOLOGY

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Young (H. E.). **Fused needle disease and its relation to the nutrition of Pinus.**—*Qd For. Bull.* 13, 108 pp., 35 figs., 1 diag., 8 graphs, 1940.

This paper, now reprinted in bulletin form, has already been noticed from another source [*R.A.M.*, xix, p. 682; see also ibid., xx, p. 40].

Mounce (Irene), Bier (J. E.), & Nobles (Mildred K.). **A root-rot of Douglas Fir caused by Poria weirii.**—*Canad. J. Res.*, Sect. C, xviii, 10, pp. 522–533, 4 pl., 2 figs., 2 maps, 1940.

A root rot of young Douglas fir (*Pseudotsuga taxifolia*) trees first observed in 1929 at the Cowichan Lake Forest Experiment Station on Vancouver Island, British Columbia, has since been found to occur generally throughout the south-eastern part of the island. It is not yet known to be present on the mainland. A survey of stands in the original area of infection showed the disease to be common in 20- to 40-year-old trees, occurring mainly in patches. In addition the causal organism has been isolated from rot in 100- and 200-year-old trees as well as from western hemlock (*Tsuga heterophylla*). In sample plots established in infection centres in young Douglas fir stands, 32 to 57 per cent. of the trees were found to have been killed by the disease.

The first external symptom of the trouble is a retardation of the growth, usually accompanied by a scanty crop of cones and a gradual thinning of the foliage. A year or two later all the needles turn brown, indicating that the tree is dead. The roots of dead trees are decayed and such trees are often found uprooted with the large roots broken off near the crown. In the transverse section of the stump of a recently killed tree a brownish stain characteristic of the incipient stage of decay is usually present in the heartwood, with numerous patches extending into the sapwood. This discoloration is found for a distance of 4 to 6 ft. in advance of the later stage of decay, which first appears as small separated areas, each traceable back to individual decayed roots. Later the entire central core of the stump is rotted, the wood is soft and flaky, yellowish to brownish, and honeycombed with small pockets, which at first may be filled with whitish fibres, but become empty. The annual rings separate easily, and tufts or sheets of mycelium containing readily visible brown setal hyphae are present between the layers and on the bark of diseased roots and the soil around them. With the exception of the colour of the mycelium, which is sometimes

pale avellaneous, the root rot of the Douglas fir closely resembles that caused by *Poria weirii* in western red cedar (*Thuja plicata*) and the sporophores found on the Douglas fir fundamentally agree with this species. A comparison of the cultural characters of the Douglas fir organism with those of *P. weirii* showed that the only difference was that of colour, *P. weirii* being deep yellow to brown, whereas the Douglas fir organism often exhibits pale avellaneous tones. It is concluded that the Douglas fir organism is either identical with or a form of *P. weirii*.

*Armillaria mellea* is stated to cause appreciable losses in stands of young Douglas firs on the island, being probably more prevalent in the central parts of it than in the Cowichan Lake region. Although it may cause a reduction in growth, discoloration of needles, and death of trees, it can easily be distinguished from *P. weirii* by the sporophores at the base. In the advanced stages of the decay caused by *A. mellea* the wood becomes light yellow or white, soft and spongy, often stringy, and marked by numerous black zone lines, thus bearing little resemblance to the *P. weirii* rot. Furthermore, in the trees affected by *A. mellea*, the needles turn pale yellowish to yellowish-brown instead of reddish-brown, an abnormal resin flow is usually found at the base of infected trees, veined white mycelial fans are abundant between the bark and wood, and dark brown or black rhizomorphic strands may be present in the cambium, on the surface of diseased roots, and free in the soil.

Berg (A.). **A rust-resistant Red Cedar.**—*Phytopathology*, xxx, 10, pp. 876–888, 1 fig., 1940.

Three grafted red cedar (*Juniperus virginiana*) seedlings, 16D, 66D, and 22X, which had proved resistant, moderately susceptible, and susceptible, respectively, to rust (*Gymnosporangium juniperi-virginianae*) [*R.A.M.*, xx, p. 24] in a 16-year trial at the West Virginia Agricultural Experiment Station, were transplanted to an apple orchard and exposed to four years' infection by the fungus. At the end of this period, the clones from 22X were so heavily infected that all died and those of 66D were severely injured, whereas those of 16D retained their high degree of resistance and would in all probability do so under natural conditions. In view of the traditional popularity of the red cedar in the Shenandoah Valley, where some resentment still prevails against the compulsory eradication of all trees within three miles of a commercial orchard, under a statute dating from 1912, in West Virginia [cf. ibid., v, p. 105], the development of a resistant variety for landscape cultivation would be of commercial value.

Edwards (J. H.). **New treatment method prolongs mine timber life.**—*Coal Age*, xliv, 10, pp. 53–55, 6 figs., 1939.

Seven Alabama coal-mining companies are stated to be now using mine timber treated by the 'osmose' process [*R.A.M.*, xix, p. 181], whereby standard preservative chemicals are mixed with a colloid so that very deep penetration after dipping or brushing green wood is effected by natural means without mechanical pressure or vacuum equipment. Approximate percentages of the constituents are: sodium

fluoride 78, potassium bichromate 3, dinitrophenol 14, and gum arabic 5, the material being supplied in the form of a dry powder and converted into a fluid aqueous paste by the admixture of sufficient water. This wet mixture must be applied to the green timber, an abundance of sap in which assists penetration by osmotic pressure and diffusion, and for at least 30 days after dipping or brushing the wood must be kept piled and covered with waterproof paper to exclude air and so prevent the natural process of drying, a further precaution consisting in the shovelling of earth round the base of the pile. In Dolomite No. 3 mine of the Woodward Iron Co. osmose-treated southern pine [*Pinus* spp.] is being exclusively used for timbering a six-heading aircourse; the 6 in. posts with 24 by 6 by 4 in. caps placed on 4-ft. centres, are treated in the field where they are cut, and the caps and wedges at the saw-mill. The Alabama By-Products Corporation started the application of osmose protection to mine ties, roof timbers, and outdoor structures in 1936, when 1,000 sap pine ties, 6 ft. by 6 in. by 6 in., were treated and installed in Barney mine; no signs of decay were apparent at an inspection of this material in March, 1939. Further applications of the method by the same and other concerns are mentioned.

In 100 and 900 lb. lots the powder costs 50 cents per lb., with transportation charges added from the Buffalo plant of the Osmose Wood Preserving Co. With the recommended $\frac{1}{4}$ lb. powder per cu. ft. of wood, or 21 lb. per 1,000 board ft., the cost of the treatment (including waterproof paper) of 1,000 board ft. is about $11.00.

Referring to the application of the osmose process by railways and public utility services, the writer quotes a paper by E. C. Thompson in *Elect. World*, 1st February 1936, stating that the Alabama Power Co. had treated 600 southern pine poles, 30 to 35 ft. long, since the previous autumn. Sodium fluoride penetration was found, 60 to 90 days after treatment, to have exceeded 2 in. on 16 out of 17 poles examined, and 3 in. in five, depth of impregnation being determined by means of the zirconium-alizarin colour reagent test [loc. cit.]. Since the original application the same company has installed over 1,000 additional poles treated in the same way.

HYLER (J. E.). **Southern treating plants increase life of Southern Pine and hardwoods.**—*Sth. Pwr & Indust.*, lviii, 9, pp. 60–64, 1940. [Abs. in *Chem. Abstr.*, xxxiv, 20, p. 7083, 1940.]

At least 75 major wood-preserving plants are stated to be operating in the southern United States, and an increasing tendency has been observed for railroads and other concerns to install their own plants. The bulk of the wood treated is pine, but hardwoods are coming into more general use. Impregnation is mostly carried out by the Rüping empty-cell process, though the Lowry method is also employed [*R.A.M.*, xix, pp. 180, 632]. Open tanks are still used, but it is doubtful whether they can be made permanently suitable or economical. Creosote is the chief preservative used, dry wood being easily finished in three or four hours, while heavy green stock may require upwards of 48, possibly with the addition of vacuum treatment and steaming if much moisture is present.

Franco (R. M.). **Mancha y seca de las hojas de la Cebolla.** [Onion leaf spot and wilt.]—*Rev. Fac. nac. agron. Colombia*, ii, 6, pp. 609–613, 1 fig., 1940.

On dark carmine, yellow-bordered lesions near the tips and bases of onion foliage affected by purple leaf spot in Colombia (where the disease was first observed by R. A. Toro in 1928), the author found conidia, which he regards as being characteristic of *Alternaria porri* [*R.A.M.*, xvii, p. 654]. The pathogen is stated to be responsible for heavy losses in Santander, where onion cultivation is practised on a commercial scale.

Snyder (W. C.). **White perithecia and the taxonomy of Hypomyces ipomoeae.**—*Mycologia*, xxxii, 5, pp. 646–648, 1940.

Single-spore cultures of a fungus morphologically agreeing with *Fusarium javanicum* obtained from infected *Cucurbita maxima* and vegetable marrow in California (all found experimentally to be highly pathogenic) gave rise after about a month to perithecial primordia which in some cultures were red, and in others white. None of the primordia developed into perithecia. Conidial suspensions from the cultures with white primordia were applied to those bearing red ones, and vice versa, and in less than a week perithecia were developing. The cultures bearing red primordia developed only red perithecia, and those bearing white primordia developed only white perithecia. Both types fell within the limits of *Hypomyces ipomoeae*. Other evidence demonstrated that both were inter-fertile and that the stable colour of the primordium and perithecium was inherited. No intermediate types of perithecial colour developed in any cross, nor did more than one type of primordium appear in any one single-spore culture. As the progeny from both the red and white perithecia were all highly pathogenic on squash, and all were morphologically identical, it was clear that only one fungus was involved. Single-ascospore cultures of the fungus belonged to two sex-reaction groups and could be described as self-sterile, inter-group fertile, intra-group sterile, and hermaphroditic. It was not possible to change either type into the other by means of ageing or applications of acid or alkali. These results emphasize the danger of using colour as a taxonomic character in fruiting structures of perfect fungi.

Su (U. T.) & Seth (L. N.). **Cultivation of the Straw Mushroom.**—*Indian Fmg*, i, 7, pp. 332–333, 2 pl., 1940.

Further information is presented concerning the cultivation of the edible straw mushroom (*Volvaria diplasia*) in Burma [*R.A.M.*, xviii, p. 156]. Beds consisting of 32 bundles of rice straw, 4 ft. long and 10 in. in diameter, steeped in water for 24 hours, and then arranged in four layers of eight bundles each, the ends of four facing one way and four another, are inoculated with spawn grown in bottles on finely chopped rice straw at 35° to 37° C. for three weeks, pieces being distributed round the edges of the two lower layers at a distance of 4 to 5 in. apart and over the whole of the third. The top layer is watered and slightly trampled. The size of the finished bed is about $3\frac{1}{2}$ by $3\frac{1}{2}$ by 2 ft. The beds are watered once daily, morning or evening, and the

mushrooms begin to appear from 15 to 20 days after inoculation, production continuing intermittently for a fortnight or so and averaging 8 lb. per bed. The total cost of making one bed is about 8 annas [9d.], so that a profit of 8 annas per bed will accrue from the sale of the mushrooms at 2 annas per lb. *V. diplasia* can be grown at any time from March to October in localities where the minimum atmospheric temperature does not fall below 70° F.

WANN (F. B.). **Chlorosis of Concord Grapes controlled by grafting: the grafting of Concord scions on vinifera rootstocks produces a Vine that is resistant to chlorosis.**—*Fm Home Sci.*, i, 1, pp. 9, 11, 1 fig., 1940. [Abs. in *Exp. Sta. Rec.*, lxxxiii, 3, p. 357, 1940.]

Proper rooting of the cuttings and cultural care were shown to be important factors in the general vigour and productiveness of Concord vines at the Utah Agricultural Experiment Station in connexion with attempts to combat chlorosis (associated with local deficiency of available iron in the soil) by grafting. The [*Vitis*] *vinifera* varieties were found to remain green and healthy under conditions in which those of the *V. labrusca* group developed the trouble, and a number of the former, including Tokay, Muscat, Malaya, Black Prince, and Rose of Peru, were successfully used as stocks for Concord scions.

CONNERS (I. L.). **Nineteenth Annual Report of the Canadian Plant Disease Survey, 1939.**—xi+112 pp., 1940. [Mimeographed.]

In this report [cf. *R.A.M.*, xviii, p. 724] the author states that during 1939 wheat stem rust (*Puccinia graminis*) was of small importance in Canada. For the first time in ten years the disease was responsible for only minor losses in Manitoba, where 77 per cent. of the wheat acreage was sown to the resistant varieties, Thatcher and Renown, about 18 per cent. to durum wheats, mainly Mindum, and the remainder to Marquis, Ceres, Reward, and other susceptible wheats. As infection was also much less prevalent than usual in the winter wheat areas in the United States, little primary inoculum reached the spring wheat areas in Canada.

Samples of wheat taken from fields selected at random in all the major agricultural soil zones in Manitoba showed on the average 21·9 per cent. of the plants affected by root rot (*Helminthosporium sativum* and *Fusarium* spp.), with an average loss of yield of 7·5 per cent. Slight head blight of wheat and barley occurred in Quebec and the maritime provinces, and of oats in Quebec. The disease, it is thought, may be much more important than these records indicate, the field surveys in question being effected before most of the crop approaches maturity. The fungi most frequently isolated from wheat were species of *Fusarium*, especially *F. graminearum* [*Gibberella saubinetii*], whereas in barley *F. poae* was the chief fungus, though *H. sativum* was also important, and all collections of oats yielded *F. avenaceum*. The fungus most commonly associated with head discoloration of wheat in Quebec and the maritime provinces was *Septoria nodorum*. Yellow leaf blotch (*H. tritici-repentis*) [ibid., xvii, p. 796] reached epidemic proportions over most of the wheat-growing area in Manitoba, and was also recorded from Saskatchewan and Quebec.

Both *S. avenae* [ibid., xiii, p. 184] and *H. avenae* [ibid., xvii, p. 809] occurred simultaneously in many fields of oats in Quebec in the summer of 1939. Halo blight (*Phytomonas* [*Bacterium*] *coronafaciens*) was noted on oats in all three prairie provinces, and was particularly prevalent in Manitoba and northern Saskatchewan. Only a portion of the Manitoba collections showed a distinct chlorotic halo about the lesion, but all yielded typical *Bact. coronafaciens*.

Lucerne bacterial wilt (*P. insidiosa*) [*Aplanobacter insidiosum*: ibid., xvi, p. 589; xviii, p. 258] was destructive in the irrigated regions of southern Alberta. Almost the only lucerne variety grown in Alberta, Grimm, is very susceptible. A new root rot of sweet clover [*Melilotus*], due to *Phytophthora cactorum*, was also noted in Alberta [ibid., xix, p. 708].

A condition affecting mangel for several years past in New Brunswick was shown to be of a virus nature, and transmissible by grafting; it was tentatively identified as curly top. Another condition in the same locality, provisionally referred to as fern-leaf, was also thought to be of a virus nature, but was not successfully transmitted by sap inoculation. Seed of crested wheat grass (*Agropyron cristatum*) from Saskatchewan was affected by smut (*Ustilago hordei*) [ibid., xviii, p. 665], not hitherto recorded on this host in Canada.

Bacterial diseases of beans caused much anxiety. Bacterial blight (*P.* [*Bact.*] *phaseoli*) was reported from Alberta eastward, while halo blight (*P.* [*Bact.*] *medicaginis* var. *phaseolicola*) was prevalent in British Columbia and was reported from Alberta and Manitoba; it was also reported on a sample of 1938 seed from Kitchener, Ontario. Carrots were increasingly affected by aster yellows [ibid., xv, p. 776] and severe infections occurred in New Brunswick and Nova Scotia. Lettuce anthracnose (*Marssonina panattoniana*) [ibid., xviii, p. 569], new to Manitoba, was severe at Brandon and near Winnipeg.

Potato bacterial ring rot (*P. sepedonica*) [*Bact. sepedonicum*: ibid., xix, p. 725] continued to be very serious. It was present in twelve towns in the irrigated areas of Alberta, and was observed for the first time in eastern Ontario, though few cases were recorded in that province. In Quebec the situation was unchanged, but in New Brunswick twice as many fields were affected as in 1938. New outbreaks were noted in Prince Edward Island, and infection was found for the first time in Nova Scotia, in one field only.

Curly top (virus), long known on tomatoes and other plants in Canada, was recorded for the first time on scattered potato plants, the disease being observed in the Okanagan Valley, British Columbia. *Phoma destructiva* was reported for the first time as a destructive rot of tomatoes in Canada, causing serious damage in a field in Ontario. A *Typhula* rot, known for some years in pit-stored turnips in British Columbia, was ascribed to *T. umbrina* [ibid., xix, p. 434].

Storey (H. H.). **Plant pathology.**—*Rep. E. Afr. agric. Res. Sta., 1939*, pp. 8–11, 1940.

In this report [cf. *R.A.M.*, xviii, p. 727], the author states that his studies at Amani have shown that cassava mosaic [ibid., xix, p. 579] is caused by a group of virus strains of varying virulence [ibid., xviii,

p. 373]. The same host is also affected by another, and quite distinct virus disease, not hitherto recognized. This the author names 'brown streak' [ibid., xviii, pp. 373, 574]. The mosaic vector at Amani was found to be a species of *Bemisia* [ibid., xviii, p. 231; xix, p. 580]. Breeding work for resistance to both diseases was begun at Kizugu substation in 1938, and among the varieties under test there was a wide range of resistance both to mosaic and brown streak. The hybrid material obtained has given promising results.

Further work in 1939 confirmed the high resistance to maize streak of certain lines of the Peruvian Yellow Flint variety [ibid., xviii, p. 727], and attempts are being made to breed a commercial type from them.

In connexion with work on the virus disease of passion fruit reported from Kenya [woodiness: ibid., xix, p. 664] a large collection of seed of *Passiflora* spp. has been made.

**Plant diseases. Notes contributed by the Biological Branch.**—*Agric. Gaz. N.S.W.*, li, 10, pp. 559–562, 3 figs., 1940.

Club root (*Plasmodiophora brassicae*) [*R.A.M.*, xix, pp. 130, 356, 509] of crucifers has been present in New South Wales for at least 45 years, but has not yet spread to all the localities where cabbages and cauliflowers are grown. Every precaution should be taken to ensure that infection is not introduced into these areas. Only clean seed-bed soil should be used; doubtfully clean soil should be sterilized by heat or chemical treatment. Where seedlings are transplanted into infected land, the site which each plant is to occupy should be treated immediately before transplanting with $\frac{1}{2}$ pt. mercuric chloride solution (1 in 2,000). In some cases applications of not less than 2 tons of hydrated lime per acre to infested soil will reduce infection.

For many years ornamental plants in New South Wales have shown a condition referred to as 'greening', marked by an excessive production of leafy structures instead of normal petals in the flower heads. Sometimes only a few heads on a plant are affected, the others remaining normal. Plants commonly showing the condition include marigold [*Calendula officinalis*], Iceland poppy [*Papaver nudicaule*], phlox, snapdragon [*Antirrhinum majus*], aster [*Callistephus chinensis*], and sunflower. The cause of the condition has not yet been ascertained, but the symptoms suggest a virus origin.

*Sclerotinia minor* was recorded on lettuce for the first time in New South Wales in August, 1940.

**Agricultural research in New Hampshire. Annual Report of the Director of New Hampshire Agriculture Experiment Station for the year 1939.**—*Bull. N.H. agric. Exp. Sta.* 319, 46 pp., 1940.

The following items of phytopathological interest occur in the Botany and Horticulture sections of this report (pp. 26–30 and 37-9). The results of O. R. Butler's experiments on apple scab [*Venturia inaequalis*] control with flotation sulphur paste (16 lb. per 100 gals.) indicated that three cover sprays (involving a supplementary treatment between the pink and calyx) did not give materially better results than two. Lime-sulphur solution is commonly believed to 'burn out' scab, but this was

not the case in the present trials, the fungus being observed to sporulate freely round the edges of the dead infected tissues.

A. F. Yeager's experiments in the substitution of mild sulphurs for lime-sulphur in scab control gave promising results, provided the former were of sufficient fineness and purity. Where excessive damage from the disease was anticipated, however, the use of lime-sulphur proved most effectual.

S. Dunn's records, covering the past eight years, afford no evidence of any correlation between the duration of the snow cover and the date of the commencement of apple scab ascospore discharge. In only three of the eight years did this process begin later than the regular date of application of the pre-pink spray, and in two of these discharge started very shortly after, namely, five and six days in 1933 and 1935, respectively. Only in 1939 would it have been practicable to omit the pre-pink spray on the basis of the ascospore discharge data.

In a comparative test on the effect of mulching on the incidence of bitter pit in apples [*R.A.M.*, xix, p. 604], leaf samples from mulched trees were found to contain more extractable potassium than non-mulched. The latter, however, produced a higher percentage of large apples in 1939. There was very little bitter pit, 0·5 and 0·03 per cent., in the fruit from the mulched trees and non-mulched, respectively. In storage the apples from mulched and non-mulched trees developed 8·62 and 3·36 per cent. disease, respectively.

Boron-sprayed apple trees were found by H. P. Latimer to drop less fruit than the untreated. Cork spot [ibid., xix, pp. 603, 659] was satisfactorily combated by the use of boron either in spray or fertilizer form. Borax applications as low as 5 lb. per acre caused a trace of leaf scorch in strawberries, increasing to severe damage at 80 lb.

**Science for the farmer.**—*Rep. Pa agric. Exp. Sta., 1939–40* (*Bull.* 399), 76 pp., 14 figs., 1 diag., 3 graphs, 1940.

The following items of phytopathological interest occur in this report [*R.A.M.*, xix, p. 200]. Twenty-nine high-yielding varieties of oats resistant to smut [*Ustilago avenae* and *U. kolleri*] (of which the five most promising are from a cross of Albion and Red Rust-proof) have been isolated by C. F. Noll from hybrids bred by him and varieties developed by the United States Department of Agriculture. In inoculation experiments the highest average infection on any of these varieties was 6·5 per cent. compared with 61 per cent. on the standard variety Patterson. C. J. Irvin reports that over a seven-year period the percentage of smutted plants resulting from inoculation ranged from 0·4 to 9 in six resistant selections, as compared with 65·1 and 17·8 for Patterson and Cornellian, respectively. The results of trials conducted by E. L. Nixon showed that two applications of sprays (usually Bordeaux mixture) made very early were more important in controlling late blight of potatoes [*Phytophthora infestans*] than two applications just before or at the time of the first appearance of the disease. A new material, cuprocide 54 Y (yellow cuprocide), was found to be a promising substitute for Bordeaux mixture.

W. S. Beach does not accept J. J. Reid and D. E. Haley's view that tobacco wildfire is caused by a physiological adaptation of the common soil saprophyte, *Pseudomonas fluorescens* [ibid., xviii, p. 764; xix, p. 48].

H. W. Thurston, Jr., and D. E. H. Frear analysed 30 samples of commercial brands and home-boiled concentrates of lime-sulphur, and found a high degree of correlation between specific gravity and polysulphide content. The importance is stressed of diluting the concentrate so as to produce a given specific gravity after dilution.

In laboratory tests conducted by C. C. Wernham, marked differences were found to exist in the susceptibility of various strains of grass, propagated by seed, to a species of *Helminthosporium* causing the 'melting-out' disease. Kentucky bluegrass [*Poa pratensis*] proved highly resistant if not immune, but timothy [*Phleum pratense*] was very susceptible. There was some evidence indicating that there may be differences in the pathogenicity of different strains of the fungus. Where the annual bluegrass, *Poa annua*, constitutes a high percentage of the turf, the attacks of the disease are stated to have been severe, particularly around Philadelphia.

Observations by W. S. Beach indicate that in addition to excess dampness and soil acidity, abundance of organic matter in the casing soil and injury caused by other organisms predispose mushrooms to attacks by *Trichoderma* spp. [ibid., xix, p. 201]. Maintenance of optimum conditions for mushroom growth in the beds is, therefore, recommended. Two species of *Diplocladium* [ibid., xiii, p. 14] were proved to be responsible for decay of mushrooms similar to that caused by *Dactylium dendroides* [ibid., xviii, p. 779], but the spread was less rapid and the damage caused was less serious.

In tests conducted by J. W. Sinden, good mushroom composts neither suffered nor benefited by the addition of gypsum [ibid., xix, p. 326] and superphosphate. Composts with excess water, on the other hand, were made to produce a crop by the addition of gypsum.

FAWCETT (G. L.). **Departamento de Botánica y Fitopatología.** *Ex* **Memoria anual del año 1939.** [Department of Botany and Phytopathology. *Ex* Annual Report for the year 1939.]—*Rev. industr. agríc. Tucumán*, xxx, 1–3, pp. 44–49, 1 fig., 1940.

The following items of interest occur in this report of the Department of Botany and Phytopathology, Tucuman [cf. *R.A.M.*, xix, p. 8]. Chlorosis of sugar-cane [ibid., xviii, p. 327] continues to attract the chief attention of growers. There is no evidence of the implication of any toxic agency in the soil, faulty nutrition being probably at the root of the trouble.

Three years' experiments in the transmission of psorosis from diseased to healthy oranges by means of *Aphis gossypii* having given negative results, it is concluded that infection is not disseminated in this manner. *Septoria* [*citri*] on the pomelo [ibid., xix, p. 8] was well controlled by spraying with Bordeaux mixture. This fruit was widely affected by chlorosis due to zinc deficiency [ibid., xvii, p. 520].

An unidentified tobacco virus, almost as destructive as that of 'corcova' [hunchback], which has been absent during the last two years, is engaging the writer's attention. Downy mildew (*Peronospora tabacina*) was observed for the first time in Argentina, destroying numerous seedlings in excessively shaded plantations.

Potatoes were attacked by *Phytophthora infestans* and 'verruga'

[presumably wart disease: *Synchytrium endobioticum*, apparently a new record for the Argentine]. The use of certified seed from Buenos Aires has contributed to a reduction in the incidence of virus disorders.

No insect vector of the serious virus disease of beets causing the growth of buds in the leaf axils [ibid., xviii, p. 328] has yet been detected. The same host is subject to spring infection by a form of mosaic, experimentally shown to be transmissible by *Myzus persicae*.

TEMPLEMAN (W. G.) & MARMOY (C. J., *née* TOWNEND). **The effect upon the growth of plants of watering with solutions of plant-growth substances and of seed dressings containing these materials.**—*Ann. appl. Biol.*, xxvii, 4, pp. 453–471, 1940.

The results of experiments carried out at Jealott's Hill Research Station (Imperial Chemical Industries Ltd.) showed that seed treatment with dressings of talc, agrosan G, or granosan plus α-naphthylacetic acid or β-indolylacetic acid in concentrations ranging from 0·01 to 1·0 per cent. failed to stimulate the germination, tillering, growth in height, or the dry matter production of oats, barley, sugar beet, or wheat grown in sand and soil in pots, or of wheat and oats grown in small-scale field experiments. Solutions of sodium α-naphthylacetate alone produced no increase in plant height or amount of dry matter in lettuce, white mustard, and tomato, except in one or two isolated instances [*R.A.M.*, xix, p. 322].

CHRISTENSEN (J. J.) & DAVIES (F. R.). **Variation in Helminthosporium sativum induced by a toxic substance produced by Bacillus mesentericus.**—*Phytopathology*, xxx, 12, pp. 1017–1033, 4 figs., 1940.

Isolates of *Bacillus mesentericus*, cultured on artificial liquid or solid media, produced a substance that suppressed growth, increased conidial development, inhibited or retarded germination, caused abnormal hyphal growth, and induced mutation in certain races of *Helminthosporium sativum* [*R.A.M.*, vi, p. 473; xvi, p. 525], of which race 1 was studied in detail. Inhibition of the growth of the fungus, but no sectoring, resulted when the two organisms were grown in close association. Malt, maize meal, and oatmeal agars were the best of the media tested for the production by *H. sativum* of variants in the presence of the bacterial toxin; variation was also affected by the concentration of the toxic substance. In general, potato dextrose agar containing 2 to 3 per cent. of the bacterium-staled broth yielded the maximum number of sectors and the greatest number of varying types.

The bacterial substance was found to be thermostable, diffusible, and capable of passage through a Berkefeld filter; it was readily adsorbed on infusorial earth, withstood freezing and desiccation, did not deteriorate appreciably during several months' standing, and was tolerant of acid, though succumbing to treatment with an alkali and being destroyed or partially inactivated by contact with *Coniothyrium*, *Dematium*, *Penicillium*, and *Cephalosporium* spp., and *Botrytis cinerea*.

Sterilized broth cultures of *Bacillus mesentericus*, added to the substrata of various fungi, suppressed the growth of the latter but did not increase the incidence of sectoring, except in the case of *H. sativum* and possibly one species of *Penicillium*, denoting a considerable degree of specificity of the toxic substance to the cereal pathogen. Even races

and variants of *H. sativum* responded diversely to the toxic influence of the bacterium. Race 1 of the fungus, growing on potato dextrose agar, gave rise to numerous variants differing from the parent culture in cultural characters, general physiology, pathogenicity, and (to some extent) morphology. Of 12 such variants a few were more virulent to wheat and barley than the parent strain, others somewhat less so, and still others virtually non-parasitic. By means of mutation *H. sativum* became adapted to a new environment, thereby simulating an accession of tolerance to the toxic substance engendered by *B. mesentericus*.

PAINTER (R. H.), JONES (E. T.), JOHNSTON (C. O.), & PARKER (J. H.). **Transference of Hessian fly resistance and other characteristics of Marquillo Spring Wheat to Winter Wheat.**—*Tech. Bull. Kans. agric. Exp. Sta.* 49, 55 pp., 8 figs., 1 diag., 9 graphs, 1940.

In a series of breeding experiments carried out in two localities in Kansas and in one in Missouri from 1932 to 1937 on the transference of resistance to Hessian fly, *Phytophaga destructor* (Say), from Marquillo spring wheat to winter wheat, the reactions of the progeny were also noted towards stem and leaf rusts [*Puccinia graminis* and *P. triticina*], bunt (*Tilletia levis*) [*T. foetens*], and mildew (*Erysiphe graminis*). Selections from the family 35 FN 742, Marquillo × Oro, combined resistance to Hessian fly with high resistance to all four diseases. Selection 35 FN 743, Marquillo × Oro, which produced the best agronomic types, was not quite equal to the foregoing in resistance to *P. graminis*, the reactions of the different lines ranging from moderate resistance to susceptibility; most of the lines were resistant to the other diseases under investigation. Nearly all the lines comprising selection 35 FN 677, Marquillo × Tenmarq, are practically equal to the latter in resistance to *P. triticina*, but only moderately resistant to *P. graminis* and fairly susceptible to mildew. The reactions of the fly-resistant selection, 35 FN 660, Marquillo × Tenmarq, to disease were not quite so promising as those of the other families, infection by *P. triticina* ranging from 10 to 30 and by *P. graminis* from 60 to 90 per cent., while all but two lines were susceptible to mildew.

The behaviour in respect of insect and disease infestation of each of the six generations involved in the investigation is fully discussed and the statistical data presented in tabular form.

HEALD (F. D.) & HOLTON (C. S.). **Flag smut of Wheat found in Washington.**—*Plant Dis. Reptr*, xxiv, 19, p. 382, 1940. [Mimeographed.]

Two collections of flag smut (*Urocystis tritici*) were made independently in August, 1940, from Hymar wheat on a farm at Goldendale, Washington, a small field of Rose wheat on the same farm also being affected. The percentage of infection in different parts of the fields ranged from 0 to 25, with an estimated average of 5. Four infected Hymar plants were also found two miles south of Goldendale.

SANFORD (G. B.) & CORMACK (M. W.). **Variability in association effects of other soil fungi on the virulence of Helminthosporium sativum on Wheat seedlings.**—*Canad. J. Res.*, Sect. C, xviii, 11, pp. 562–565, 1940.

A preliminary account is given of experiments (begun in 1933)

made under pure culture conditions to demonstrate the antagonism displayed by 24 isolates of *Penicillium* spp., 8 of *Actinomyces* spp., and several other miscellaneous soil-inhabiting fungi to the pathogenicity of *Helminthosporium sativum* on wheat seedlings.

The [tabulated] results showed that when the *Penicillium* isolates were associated with *H. sativum*, the virulence of the latter ranged from 16 to 97 per cent., as compared with 73 per cent. for *H. sativum* alone. *P. simplicissimum* and *P. fuscum* reduced this rating by 57 and 42 per cent., respectively. Of two isolates of *P. chrysogenum*, one depressed virulence by 39 per cent., while the other increased it by 20 per cent. One isolate of *P. expansum* depressed virulence by 31 per cent., while two others had virtually no effect. One isolate of *P. glabrum* and two of *P. terrestre* depressed virulence by 24, 18, and 11 per cent., respectively. *P. trzebinskii* had no effect, and *P. rugulosum* increased virulence by 22 per cent. Of four isolates of *P. viridicatum*, two reduced virulence by 22 and 17 per cent., respectively, one had no effect, and the fourth increased virulence by 11 per cent. One isolate of *P. chloroleucon* depressed virulence by 17 per cent., while another had no effect. Two isolates of *P. cyclopium* had no effect. Of the four remaining unidentified species of *P.*, one depressed virulence by 11 per cent., two had no effect, and one increased virulence.

In comparison with a disease rating of 66 per cent. for *H. sativum*, four isolates of *Actinomyces* depressed virulence by 33, 22, 22, and 11 per cent., respectively, two had no conspicuous effect, and two increased it by 12 and 16 per cent., respectively.

Among the miscellaneous fungi an isolate of *Trichoderma viride* reduced the infection rating by 58 per cent., two of *T. lignorum* [*T. viride*] reducing it by 56 and 50 per cent., respectively. An isolate of *Absidia glauca* reduced infection by 39 per cent., and one of *Aspergillus nidulans* by 30 per cent. Other fungi tested appeared to exert no influence on virulence.

It is concluded that within a given species some isolates may exert no effect on the virulence of a pathogen, while others may depress it, and yet others increase it.

BRANDWEIN (P. F.). **Infection studies on the covered smut of Oats.**—*Bull. Torrey bot. Cl.*, lxvii, 8, pp. 673–691, 1940.

The writer's technique for the inoculation of oats with covered smut (*Ustilago levis*) [*U. kolleri*] and the germination and planting of the seedlings has already been described [*R.A.M.*, xviii, p. 243]. In order to determine the effective periods of infection, batches of seed and seedlings of three varieties representing different categories of susceptibility were inoculated every six hours with dry chlamydospores of race 7 of the fungus with the following results. The highly resistant Markton showed 2·7 and 1·9 per cent. infection at the zero and 18-hour stages (from time of planting), respectively, but was immune thereafter; Black Mesdag (partially susceptible to race 7 of the smut) developed 70·9 and 85·5 per cent. infection at zero and six hours, respectively, the incidence falling to 8·7 at 60 hours; while the highly susceptible Monarch contracted 100 per cent. infection throughout the 0- to 30-hour period, with a decline to 4·9, 2·1, and 1·9 per cent. 96, 102, and 126 hours,

respectively, after planting. The periods of effective infection for Monarch and Black Mesdag were limited to the first 132 and 100 hours, respectively, and the periods of maximum infection were calculated to fall between 36 and 72 and 36 and 54 hours, respectively, after planting, the highly susceptible variety having a longer period of infection and a longer effective period of maximum infection than the partially susceptible. During the effective periods of infection the growth rates of the seedlings of the three test varieties were remarkably uniform, increasing between 48 and 96 hours after planting (a period of rapidly diminishing infection percentages) some 480 per cent. over the rate during the first 48 hours. The resistance of Markton, which in the light of these data cannot be explained on the basis of growth rate, is tentatively attributed to the existence of a specific internal factor unfavourable to the development of the smut, inoculation with which, under the controlled environment of these studies, exerted no adverse effect on the resistant host.

Regional infection experiments on Monarch seedlings showed that, though the smut may penetrate the mesocotyl and develop therein, no sporulation results. The maximum incidence of sporulating infection appears to succeed the invasion of the coleoptile.

Three sets of factors would appear to be operative in the relationship between *U. kolleri* and its host, namely, a specific internal factor analysable on a genetic basis, environmental conditions, and a growth factor, the first-named governing true resistance and the other two the incidence and extent of infection in susceptible seedlings. The use of the following definitions is suggested with a view to simplifying the discussion of systemic infection by *U. levis*: (*a*) seedling invasion, occurring in both susceptible and resistant varieties and not necessarily terminating in sporulation; (*b*) non-sporulating 'latent' or 'blasting' infection [ibid., xii, p. 209; xvii, p. 451]; and (*c*) sporulating infection, expressed by the fruiting of the fungus in the reproductive organs of the host.

McNew (G. L.) & Braun (A. C.). **Agglutination test applied to strains of Phytomonas stewarti.**—*Bot. Gaz.*, cii, 1, pp. 64–77, 1940.

In studies [which are fully described] made to identify by means of the agglutination test 90 single colony isolates of *Phytomonas* [*Aplanobacter*] *stewarti* [*R.A.M.*, xix, p. 694] obtained from 27 naturally infected maize plants growing in fields at Princeton, New Jersey, three isolates failed to agglutinate in the two sera employed, some agglutinated in one or other but not both, and the remainder agglutinated in both at dilutions of 1:20 to 1:2,560. In all, 15 strains were studied. No consistent difference was observed in the serological properties of isolates from susceptible and resistant inbred lines. Some isolates from the same leaf lesion differed as widely as others from different plants.

Strains from the same culture differed in serological characters, which were not correlated with any particular colony characteristic, physiological ability, or degree of virulence. Strains from various places in the United States and Mexico differed no more from one another than did some variants from one strain. Some of the strains agglutinated in all sera and usually at the high titres of 1:1,280 to 1:5,120. These strongly

agglutinating strains generally induced immune sera that failed to agglutinate five of the strains, while poorly agglutinating strains gave sera effective against every culture tested. Several other species of wilt-producing bacteria failed to agglutinate in anti-serum for three strains of *A. stewarti*.

The results obtained show that the agglutination test has limitations when applied to *A. stewarti*. In making agglutination tests for the identification of cultures more than one serum would have to be used, and even the failure of a strain to agglutinate would not be evidence that it was not a strain of *A. stewarti*. There would appear, however, to be no valid reason why agglutination in immune serum for *A. stewarti* should not be accepted as evidence that the strain belongs to the species. Apparently the serological characters of *A. stewarti* change very easily, and the ability of this organism to produce new types probably explains the presence of serologically distinct strains in the same leaf lesion.

MITCHELL (H. H.) & BEADLES (JESSIE R.). **The impairment in nutritive value of Corn grain damaged by specific fungi.**—*J. agric. Res.*, lxi, 2, pp. 135–141, 1940.

In experiments carried out in Illinois the infection of maize with *Diplodia zeae* and *Fusarium moniliforme* [*Gibberella fujikuroi*: cf. *R.A.M.*, x, p. 180] definitely impaired the digestibility of the contained nitrogen and energy and the nutritive value of the protein and energy for the promotion of growth in the rat. Damage done by *G. fujikuroi* may be more severe than that by *D. zeae*. The fungi changed the chemical composition of the maize, causing above all a marked loss in ether-extractable constituents. Maize infected with *G. saubinetii* to the extent of 53 per cent. diseased kernels proved to be extremely toxic to young albino rats, so that too little was eaten to permit a fair test of its effect on the maize protein.

FAWCETT (H. S.) & BITANCOURT (A. A.). **Observações sôbre as doenças dos Citrus no Paraguai.** [Observations on Citrus diseases in Paraguay.]—*Biológico*, vi, 10, pp. 289–296, 1940. [English summary.]

The major diseases of citrus observed in the Asunción region of Paraguay during a tour of inspection in April, 1937, were foot rot (*Phytophthora* spp., including *P. parasitica*), isolated from rotted lemons; a very severe form of leprosis [*R.A.M.*, xviii, p. 101; xix, p. 85] involving the branches, leaves, and fruit, affected oranges being much defaced by numerous sunken, black, annular lesions; sweet orange scab (*Elsinoe australis*) [ibid., xix, pp. 341, 366] on sweet and bitter oranges, lemons, and tangerines, believed to have long been established in Paraguay (the presence of the bitter orange pathogen, *E. fawcetti*, in the country is regarded as doubtful); psorosis (mild attacks only) and a disorder of lemons known as 'concave gum disease' ('Citrus diseases and their control', 2nd edition, 1936, pp. 215–216), shown by the first-named author to be due to a virus allied to that responsible for psorosis; crotch disease of tangerines, characterized by the formation of cankers in the crotches, and having some analogies with bark rot in the East;

and false canker [loc. cit., p. 245] of lime, rough and common lemons, and citron (also observed on bitter orange in the province of Corrientes, Argentine Republic).

Of minor importance are melanose (*Diaporthe citri*), stem-end rot (*Diplodia* [? *natalensis*]), *Diplodia* and *Fusarium* rot of tangerines, lemon anthracnose (*Gloeosporium limetticolum,* not to be confused with *Colletotrichum gloeosporioides*), foliocellosis, greasy spot or false melanose [*R.A.M.* vi, p. 359], *Alternaria*, anthracnose (*C. gloeosporioides*), and brown rot of lemons, stylar end rot of Tahiti limes, mesophyll collapse, generally attributed to defective nutritional and water supplies, algal leaf and bark spot (*Cephaleuros mycoidea*), and 'felts' (*Septobasidium* spp. [cf. ibid. xx, p. 13].

MINZ (G.). **Early diagnosis of Jaffa Orange blemishes and diseases by means of ultra-violet rays.**—Reprinted from *Palest. J. Bot.*, R Ser., iii, 1–2, 4 pp., 1940.

When Jaffa oranges were exposed to ultra-violet rays emitted by a 'Philora' lamp (type HPW 57202E/70 120W, produced by Messrs. Philips) [cf. *R.A.M.*, xvii, p. 702] it was observed that in healthy fruits the flavedo and white albedo gave, respectively, an amparo purple and a pale amparo purple fluorescence. In fruits affected with stem-end rot (*Diplodia* [*natalensis*]) or green mould (*Penicillium digitatum*) [ibid., xx, p. 13] the flavedo showed a martius yellow fluorescence, while the albedo was amparo blue. In fruits affected with stem-end rot the flavedo ceased to emit fluorescence when it turned brown to the naked eye, as did the albedo when turning light brown. When oranges artificially inoculated with *D. natalensis* or *P. digitatum* were exposed, no optical changes became apparent during the incubation period, but fluorescence began when the fruits had somewhat softened.

Fissures and punctures gave a 'clear dull green-yellow' fluorescence. Deep pox (nooksan) [ibid., xix, p. 88] and hail spots gave a deep lavender fluorescence. Superficial pox (nooksan) was deep lavender, sometimes with clear dull green-yellow spots. Oleocellosis [ibid., xviii, p. 307] appeared as clear dull green-yellow spots, and pressure spots were oural green to clear dull green-yellow.

Other experiments showed that the ethereal oil obtained by puncturing, extraction, or pressure gave a clear dull green-yellow fluorescence, while fresh ethereal oil expressed and filtered through filter paper was pale viridine yellow, the residue being calliste green.

It is assumed that the distinct fluorescence of injured, blemished, and diseased fruit is due to the presence of ethereal oil. Ultra-violet lamps may perhaps be of value in detecting fruit blemishes, but not fruit rots.

BRITON-JONES (H. R.). **The diseases of the Coconut Palm.**—xvi+176, pp., 37 pl. (1 col.), 1 diag., 2 graphs, London, Baillière, Tindall & Cox, 1940. 10*s*. 6*d*.

The manuscript of this book, completed only a short time before the author's death in November, 1936, has been revised and brought up to date by E. E. Cheesman. Valuable information, intended primarily for growers and agricultural officers with limited research and library

facilities, is presented in a simple and readable form on the 'bud rot' complex (chapter I); bronze leaf wilt (II); *Phytophthora* bud rot (III); tapering stem wilt or pencil point disease (IV); red ring disease (V); false wilt and lightning strike (VI); the stem-bleeding disease (VII); root diseases (VIII); leaf diseases (IX); and gumming disease and dropping of nuts (X).

Among other problems to which the writer devoted personal attention was that of the etiology and control of bronze leaf wilt [*R.A.M.*, xvii, p. 390]. Drought is believed to be the chief immediate cause of the disorder, which is responsible for heavier losses in Trinidad than all the other diseases together. It may be combated partly by effective drainage, but more drastically, where the gravity of the situation demands such a step, by the timely felling of every other palm in a bearing plantation in order to prolong the life of the remainder. Thanks to the ease with which mortality from the disease can now be predicted some years before the fatal stage is reached, this method of elimination has been greatly simplified, but it stills remains to be seen whether it is economical.

Observations in Trinidad, Jamaica, and other West Indian islands led to the conclusion that Ashby's 'leaf-bitten' disease complex [ibid., xv, p. 136] is merely the expression of different phases of non-fatal infection by *Phytophthora palmivora*, *Thielaviopsis* [*Ceratostomella*] *paradoxa* being a secondary parasite on moribund tissue and the yeast a pure saprophyte. The intensity of little or bitten leaf depends on the height in the crown at which *P. palmivora* occurs, the severity of infection increasing from the upper to the lower range and culminating in bud rot proper, entailing the destruction of the buds. Both the bitten-leaf condition and complete recovery from bud rot are common in Trinidad in palms over five years old. Control of *P. palmivora* should consist in cutting down the palm at ground-level and making a pile of the sectioned stem and crown in such a way as to bring the soft rotting tissue of the 'cabbage' and young leaves to the bottom of the pile.

Tapering stem wilt or 'pencil point' may be associated with a variety of adverse environmental conditions involving the starvation of the plant, an important contributory cause in Trinidad having been the protracted drought of 1926, while continuous soil erosion [ibid., xvi, p. 670] along the coast is another factor to be taken into consideration.

A 16-page bibliography is appended.

WEINDLING (R.). **Sodium hypochlorite shows promise as a seed treatment.**—*Phytopathology*, xxx, 12, pp. 1051–1052, 1 fig., 1940.

Very satisfactory control of damping-off (*Glomerella gossypii*) on heavily infested cotton seed [*R.A.M.*, xx, p. 14] was secured in recent tests at the South Carolina Agricultural Experiment Station by treatment with sodium hypochlorite, used either as a dust at the rate of 1½ to 4 oz. per bush. or in the form of a solution consisting of 150 gm. B–K (a commercial preparation of the compound) in 1,000 c.c. water and containing 6 per cent. available chlorine. The results of the spray treatment were somewhat superior to those obtained with the dust, which approached in efficacy the present standard treatment with new improved ceresan.

Miller (P. R.) & Weindling (R.). **A survey of Cotton boll rot diseases in 1940 and the microorganisms connected with them.**—*Plant Dis. Reptr*, xxiv, 20, pp. 417–423, 2 maps, 1940. [Mimeographed.]

The extensive distribution of *Glomerella gossypii* in the cotton belt east of Texas and Oklahoma was again the outstanding feature of the co-operative survey of boll diseases directed by the authors in 1940 [*R.A.M.*, xx, p. 14]. The pathogen was present in only 11·1 per cent. of the Texas, Oklahoma, and New Mexico samples as against 89·6 for all others. In contrast to the previous year, however, no gradual decline of infection westward through Louisiana and Arkansas was registered, possibly owing to the prevalence of favourable climatic conditions for the disease in the south, indicated by its occurrence in nearly 100 per cent. of the Mississippi samples. *Alternaria* spp. came next in order of frequency. The fact that *Phytomonas* [*Bacterium*] *malvacearum* was isolated from green, water-soaked spots on the bolls in the Texas, Oklahoma, and South Carolina samples, in some, but not all, of which *G. gossypii* was also present, is interpreted as pointing to the origination of the lesions by the bacterium, the anthracnose fungus and others entering as secondary invaders. In Mississippi, however, the samples showed few water-soaked spots but abundant infection by *G. gossypii*, the exact mode and period of ingress of which must therefore be left open pending further investigations.

Richardson (A. S.). **Report of the Director of Agriculture.**—*Rep. Dep. Agric. Nyasald, 1939*, pp. 3–11, 1940.

In this report it is stated that cotton production throughout Nyasaland fell heavily in 1939 as a result of weather conditions favouring boll rot (*Bacterium malvacearum*) [*R.A.M.*, xix, pp. 533, 701]. In some areas the disease virtually destroyed the main crop.

Blank (L. M.). **The susceptibility of Cotton seedlings to Phymatotrichum omnivorum.**—*Phytopathology*, xxx, 12, pp. 1033–1041, 1 graph, 1940.

Inoculation experiments were performed at the Texas Agricultural Experiment Station with sclerotia of *Phymatotrichum omnivorum* [*R.A.M.*, xix, p. 702] on Rogers Acala cotton seedlings raised in metal cans in Houston black clay soil with the moisture adjusted to 27, 36, and 45 per cent. of the water-holding capacity and the temperature regulated to 80° to 85° F., a range known to be favourable to the host and parasite. The infection of older (36 days) cotton seedlings was heavier and developed more rapidly than that of younger ones (28 and 21 days). Statistical analyses showed that the two higher soil moisture groups did not differ significantly in the amount of disease produced, which considerably exceeded that occurring in the drier soil. In another experiment the final percentage of root rot eventually rose to over 90 per cent. in all three age groups (10, 20, or 30 days after planting), whereas in seedlings inoculated at the time of planting no symptoms appeared until 31 days later and only affected 25 per cent. of the stand at 48 days. Symptoms appeared more quickly in the 30-day age group than in the 20- or 10-day groups.

The accumulation of carbohydrates in the seedling tissues, roughly coinciding with a sharp increase in susceptibility to infection by *P. omnivorum*, indicates the importance of the nutritional relationship between the host and its parasite. The admixture of starch ($\frac{1}{2}$ per cent. or more) with an agar medium or autoclaved soil ($1\frac{1}{2}$ per cent. by moist weight) enhanced the virulence of the fungus to such a degree that seedlings inoculated immediately after germination readily contracted infection.

Dutky (S. R.). **Two new spore-forming bacteria causing milky diseases of Japanese Beetle larvae.**—*J. agric. Res.*, lxi, 1, pp. 57–68, 6 figs., 1940.

Full descriptions are given of two new spore-forming bacteria, *Bacillus popiliae* n.sp. and *B. lentimorbus* n.sp., parasitic on the larvae of Japanese beetles (*Popilia japonica*) at the New Jersey Agricultural Experiment Station, the former organism being responsible for the milky disease proper and the latter for type B, in which the overwintered larvae turn muddy brown instead of milky white.

Tate (P.). **On Mycetosporidium jacksonae n.sp. parasitic in species of Sitona weevils.**—*Parasitology*, xxxii, 4, pp. 462–469, 2 pl., 1940.

A full description [without a Latin diagnosis] is given of *Mycetosporidium jacksonae* n.sp., first observed by Miss D. Jackson in 1928 in the gut and malpighian tubules of *Sitona* weevils. The life-history of the organism, the systematic position of which is obscure, comprises vacuolated and compact plasmodia giving rise to spherical, multinucleate bodies; sporulation results in the formation, within thin-walled sporangia, of 8-nucleate, biconvex spores with densely staining, resistant walls. Other types of multiplication consist in the development direct from the plasmodia of small, uninucleate, fusiform bodies, and of the production, within each chamber of a multilocular sporangium, of four to six small, uninucleate, ovoid or fusiform elements.

Flatla (J. L.). **Ringorm hos Ræv.** [Ringworm in Foxes.]—*Skand. Vet-Tidskr.*, xxix, pp. 753–780, 28 figs., 1939. [English summary.]

An account is given of the author's comparative experimental and cultural studies on ringworm in the silver fox and among cattle in Norway, the fungus implicated in the former case being *Trichophyton gypseum asteroides* [*T. mentagrophytes*: *R.A.M.*, xix, p. 215] and in the latter *T. faviforme album* [*T. album*: ibid., xvii, p. 599]. In one instance *T. album* was found to be not only viable, but still pathogenic, in skin scrapings kept for four years. The cattle fungus is only mildly pathogenic to foxes, the rarity of ringworm among which is readily explained by their specific reaction to *T. mentagrophytes* alone.

Carpano (M.). **Sulla splenomegalia micotica. (Interessante caso di splenite ifomicetica in un giovane Agnello da Asteroides splenicus ovis n.s.).** [On mycotic splenomegaly. (An interesting case of hyphomycetic splenitis in a young Lamb due to *Asteroides splenicus ovis* n.sp.).]—*Riv. mil. Med. vet.*, iii, 1, pp. 1–15, 4 figs., 1940. [English summary.]

The existence of primary mycotic splenomegaly has hitherto been a

debatable problem [*R.A.M.*, xii, p. 445 *et passim*], but the writer claims to have obtained evidence of the involvement of a new species (ad interim) of *Asteroides* (a genus of the Microsiphonales erected by Puntoni and Leonardi: *R.C. Accad. Lincei.*, xx, p. 468, 1934), *A. splenicus ovis*, in the causation of the disease in a lamb in Albania. The organism proved to be non-pathogenic to laboratory animals and non-cultivable on artificial media. It is characterized by elongated, undulating, sometimes curved hyphae, up to over 100 by 1 to 2 $\mu$, composed of bacilliform, rectangular segments becoming progressively shorter towards each extremity and terminating in cubical or polyhedral elements.

Da Fonseca (O.) & De Arêa Leão (A. E.). **Agente etiologico da doença de Lobo.** [The etiological agent of Lobo's disease.]—*Rev. méd.-cirurg. Brasil, 1940*, p. 7, 1940. [Abs. in *Bol. Ofic. sanit. pan-amer.*, xix, 10, p. 1015, 1940.]

Portuguese and Latin diagnoses are given of *Glenosporella loboi* da Fonseca & de Arêa Leão n.sp., the agent of a blastomycotic granulomatous disease of man, originally described by Prof. J. Lobo from Recife, Brazil, in 1933.

Goldberg (L. H.). **Torula infection of the central nervous system.**—*J. Lab. clin. Med.*, xxvi, 2, pp. 299–301, 1940.

Particulars are given of a fatal case of infection of the central nervous system in a 19-year-old girl at Nyack, New York, by *Torula histolytica* [*Debaryomyces neoformans*: *R.A.M.*, xx, p. 61]. In a personal communication to the writer, R. G. Magruder advised that, where the fungus is suspected, a drop of sediment from centrifuged spinal fluid should be mixed with a drop of Greenthal's stain on a slide and examined under a cover glass. The stain will clearly distinguish the nuclei and cytoplasm of the usual cells from the fungal elements, which show a definite cellulose-like wall, surrounded by a wide bluish or purplish capsule. The diagnosis should be confirmed by culture, in which the organism generally reproduces by budding only and does not ferment sugar.

Beeler (R. C.), Collins (J. N.), & Loehr (W. M.). **The roentgenological aspects of pulmonary mycotic infection.**—*J. Indiana med. Ass.*, xxxiii, 11, pp. 613–616, 4 figs., 1940.

Following a brief survey of the mycology, pathology, and clinical features of the bronchomycoses associated, *inter alia*, with coccidioidal granuloma [*Coccidioides immitis*], *Monilia* [*Candida*], and torulosis [? *Debaryomyces neoformans*], the writers enumerate the roentgenological manifestations pointing towards a diagnosis of fungous disease of the lung [*R.A.M.*, xx, p. 61]. Observations at Indianapolis emphasize (*a*) the close similarity of this group of diseases to tuberculosis, both clinically and roentgenologically, (*b*) the utility of X-ray examinations, no matter how inconclusive or difficult they may be to interpret as long as they promote a bacteriological study of the causal organism, and (*c*) the possibilities of satisfactory therapy consequent on early diagnosis. The co-operation of practising physicians, pathologists, and roentgenologists is required in a more diligent search for the bronchomycoses.

De Almeida (F.) & Lacaz (C. da S.). **Processos pulmonares mixtos, com especial referencia á associação tuberculo-micotica.** [Mixed pulmonary processes, with special reference to the tuberculo-mycotic association.]—*Ann. paulist. Med. Cirurg.*, xxxix, 5, pp. 357–364, 1 fig., 1 graph, 1940. [English summary.]

Of 488 specimens of sputum examined at the Faculty of Medicine, University of São Paulo, 20 (4·09 per cent.) were found to contain mixtures of *Mycobacterium tuberculosis* and various fungi, including species of *Actinomyces*, *Torulopsis*, *Rhodotorula*, and *Paracoccidioides brasiliensis* [*R.A.M.*, xix, p. 537]. The intervention of the last-named resulted in a rapid and fatal termination of the disease. The percentage of cultures giving rise to fungi alone in the above-mentioned series of cases was 33·6.

Liston (W. G.) & Cruickshank (L. G.). **On thrush, with special reference to vaginal thrush.**—*Edinb. med. J.*, N.S. (iv), xlvii, 6, pp. 369–390, 4 figs., 1 graph, 1940.

This is a comprehensive survey of the historical, taxonomic, morphological, cultural, and clinical aspects of thrush (*Oidium* [*Candida*] *albicans*), with special reference to the vaginal form, based on the examination of 49 cases. Discussing the nomenclature of the causal organism, the authors plead for the retention of the long-established name, *O. albicans*. Much importance is attached to the hydrogen-ion reactions of the pathogen, the mean $P_H$ reading of the vaginal samples in 32 of the patients under observation being 4·4.

Baltzan (D. M.). **Bronchomoniliasis in Saskatchewan.**—*Canad. med. Ass. J.*, xliii, 3, pp. 224–228, 6 figs., 1940.

Details are given of two cases of bronchomoniliasis, both in men, associated with unidentified species of *Monilia* [*Candida*], this being apparently the first record of the disease for Canada.

Laffer (N. C.). **A note on Saccharomyces fragilis Jørgensen associated with pathologic conditions in human beings.**—*J. Lab. clin. Med.*, xxvi, 2, pp. 294–296, 1940.

Details are given of the writer's cultural study at the University of Arizona on an organism isolated by H. Miller from the throat of a male patient suffering from acute tonsillar infection and classified as *Candida pseudotropicalis* (A study of pathogenic yeasts. Doctor's Dissertation, University of Illinois, 1936). This is regarded by Diddens and Lodder [*R.A.M.*, xviii, p. 525] as the imperfect stage of *Saccharomyces fragilis*. The culture produces one to four ascospores per ascus on carrot blocks or carrot infusion agar after three days or more at room temperature. The examination of colonies on malt extract agar streak plates showed pseudomycelia penetrating the substratum, with the groupings of the blastospores at the junction of the adjoining elements similar to those of the control culture of *S. fragilis* Jørgensen from the Lister Institute. After 24 hours in malt extract broth the cells, which are mostly rod-shaped, measure 6 to 10 by 3 to 5 $\mu$, and the few filamentous 12 to 21 $\mu$ in length. The biochemical changes produced by the throat culture and *S. fragilis* were the same, viz., acid and gas in glucose, fructose,

galactose, mannose, lactose, and inulin, and the former only in raffinose; litmus milk turned acid, with evidence of gas production, after a few days at room temperature, and curdled at 37° C.; there was no true liquefaction of gelatine, but softening occurred after 42 days at 18° to 25°.

This is the third case to be reported of human infection by *S. fragilis*, which was named *S. cavernicula* by Redaelli in 1925 and *Monilia pinoysimilis* var. *citelliana* by the same author and Ciferri in 1935. Its prevalence in milk products would explain its location in the throat.

Bolaños (L.). **Costa Rica.**—*Rev. méd. Costa Rica, 1940,* p. 182, 1940. [Abs. in *Bol. Ofic. sanit. pan-amer.*, xix, 10, p. 1016, 1940.]

The following mycoses were observed in Costa Rica: ringworm of the scalp (*Microsporon lanosum*) in four children and a doctor, probably due to the importation of infected animals; numerous trichophytoses; one case of pulmonary and two of abdominal actinomycoses; and one each of sporotrichosis and pulmonary aspergillosis.

Casals (A.). **Tricomicosis en Cuba.** [Trichomycosis in Cuba.]—*Rev. méd. cubana,* xl, p. 1087, 1939. [Abs. in *Bol. Ofic. sanit. pan-amer.*, xix, 10, p. 1016, 1940.]

The majority of Cuban ringworms have been found to be caused by *Microsporon felineum* (33 cases investigated), only one each of *Trichophyton violaceum*, *T. acuminatum*, and *T. rosaceum* having been observed. *M. felineum* was also responsible for four cases of kerion.

Emmons (C. W.). **The isolation and pathogenicity of Pityrosporum ovale.**—*Publ. Hlth Rep. Wash.*, lv, 29, pp. 1306–1312, 1 pl., 1940.

*Pityrosporum ovale* [*R.A.M.*, xix, p. 94] is stated to have been repeatedly and easily isolated from the scalps of patients with seborrhoea or dandruff by planting untreated scales in dextrose broth ($P_H$ 5·5) with the addition of 23 to 44 per cent. glycerine, the cultures being incubated at 30° to 37° C. Subcultures were made by grinding some of the primary culture with broth in a mortar and pipetting on to previously prepared agar slants. No experimental evidence of pathogenicity of the fungus could be obtained, and it is consequently regarded as a saprophyte, particularly well adapted to growth on the skin, but not concerned in the etiology of the associated disorder.

Scotti (G.) & Tripodi (P.). **Sopra un caso di pitiriasi versicolore acromizzante.** [On a case of achromatic pityriasis versicolor.]—*Rif. med.*, lvi, 16, pp. 506–510, 513, 5 figs., 1940.

*Malassezia furfur* was isolated from the squamae of the extensive lesions of achromatic pityriasis versicolor [*R.A.M.*, xix, p. 474] developing in a 23-year-old male Italian as a sequel to prolonged exposure to sunlight.

Dimock (A. W.). **Importance of Verticillium as a pathogen of ornamental plants.**—*Phytopathology*, xxx, 12, pp. 1054–1055, 1940.

Strains of *Verticillium* have been isolated during the past two years at Cornell University (New York) from *Aconitum fischeri* var. *wilsoni*,

*Delphinium ajacis*, foxglove (*Digitalis purpurea*), mignonette (*Reseda odorata*), *Salpiglossis sinuata*, cineraria (*Senecio cruentus*) (all new host records), *Papaver orientale*, *Phlox drummondii*, *P. paniculata* (all first reports from North America), *Antirrhinum majus*, *Centaurea cyanus*, *Chrysanthemum morifolium*, sweet pea, geranium (*Pelargonium hortorum*), *Physalis alkekengi*, *Rosa* sp., and *Tagetes erecta*. All the cases except those of *Delphinium ajacis* and *T. erecta* were of natural infection.

In inoculation experiments with chrysanthemum strains of the fungus, *C. morifolium*, *A. majus*, cineraria, *Phlox drummondii*, and *Centaurea cyanus* were found to be both highly susceptible to, and intolerant of, infection, *D. ajacis* was moderately susceptible but very intolerant, while *T. erecta* was very susceptible but tolerant. Lupin and stock (*Matthiola incana*), both reported as hosts of the fungus in Europe, failed to contract infection in these tests. *Chrysanthemum morifolium* and *A. majus* were attacked, not only by their own strains of the organism, but also by those from geranium, *S. sinuata*, *R. odorata*, cineraria, *P. drummondii*, and *Physalis alkekengi*. In fact, the experiments yielded no evidence of host specificity among the strains under investigation, all of which, given appropriate environmental conditions, would probably attack most of the other test plants.

*Verticillium* is present in almost any planting of *C. morifolium* comprising a number of different varieties. The soil in which this crop has been grown, therefore, should be sterilized before replanting with other ornamentals, especially those as susceptible as *A. majus*, *Centaurea cyanus*, *Phlox drummondii*, and cineraria.

BAKER (K. F.), SNYDER (W. C.), & HANSEN (H. N.). **Some hosts of Verticillium in California.**—*Plant Dis. Reptr*, xxiv, 20, pp. 424–425, 1940. [Mimeographed.]

*Fuchsia hybrida* and geraniums (*Pelargonium domesticum* and *P. hortorum* Bailey), the former represented by the Lady Washington variety, have been found to show typical wilt symptoms in Alameda County, California, and *Verticillium albo-atrum*, not hitherto reported on these hosts [but cf. preceding abstract] has been isolated from them. Other plants already recorded as harbouring *Verticillium* in the State are cowpea, chrysanthemum, and *Antirrhinum majus*, while a new host for *V. albo-atrum* in the United States is China aster (*Callistephus chinensis*), a few plants of which in commercial seed fields in Santa Barbara and Los Angeles Counties yielded the organism. The affected individuals showed symptoms suggestive of *Fusarium* wilt [*F. conglutinans* var. *callistephi*], and it is thought that some cases of reported breakdown of resistance to the latter disease in the eastern and middle-western States may actually be attributed to *V. albo-atrum*. In fact, 20 per cent. of the specimens received from the Middle West as typical of *Fusarium* wilt yielded only *V. albo-atrum*.

McWHORTER (F. P.). **Brief notes on plant diseases.**—*Plant Dis. Reptr*, xxiv, 21, pp. 442–443, 1940. [Mimeographed.]

A large planting of dahlias of various horticultural types in a park at Astoria, Oregon, was found in October, 1940, to be heavily infected by

smut (*Entyloma dahliae*) [*R.A.M.*, xviii, pp. 478, 726; xix, p. 365], the round, black spots of which were so abundant as to coalesce over the leaf surfaces. The outbreak is of special interest in view of the previous detection, in 1935, of the possibly related *E. calendulae* on *Calendula* [ibid., xvii, p. 656] in the same park only 250 yards distant from the dahlia beds. *E. calendulae* was again observed just outside the town in 1938. Some 20 other dahlia plantings in and near Astoria are apparently free from smut.

DOUGLAS (M. E.). **The case of rotty Irises. An amateur's observations of Iris susceptibility and resistance to soft-rot; other reflections of the Iris year.**—*Bull. Amer. Iris Soc.* 76, pp. 64–78, 1940. [Abs. in *Biol. Abstr.*, xiv, 10, p. 1624, 1940.]

This is a report of observations made on the varietal reaction of over 500 bearded irises to rhizome rot (*Erwinia carotovora*) [*R.A.M.*, xviii, p. 31]. Among the 266 varieties classed as resistant, 27 per cent. were found on analysis to have a collective susceptible ancestry of 27 per cent., the corresponding figure for 237 susceptible varieties being 41. The susceptible components in the ancestry of modern iris varieties are stated to be *Iris cypriana* and *I. mesopotamica* with its clone Ricardi, while the resistant are *I. pallida*, *I. variegata*, and the variety Dominion (Cordelia × Amas).

WEISS (F.) & SMITH (F. F.). **A flower-spot disease of cultivated Azaleas.**—*Circ. U.S. Dep. Agric.* 556, 28 pp., 14 figs., 1940.

Much of the information presented in this comprehensive account of the azalea (*Rhododendron*) flower spot caused by *Ovulinia azaleae* has already been noticed from another source [*R.A.M.*, xix, p. 412], but the following points are of interest. The most susceptible varieties are those of the Indian (*R. mucronatum*, *R. pulchrum*, and *R. simsii*) and Kurume (*R. obtusum*) groups, the former including Formosa, Brilliant, Pride of Mobile, Comte de Nieuport, Prince of Orange, and the forcing hybrids of Dutch and Belgian origin, such as Mme Petrick, Prof. Wolters, and Vervaeneana, and the latter Pink Pearl; the symptoms on Kurume varieties, however, are generally less conspicuous than those exhibited by the Indian group. Experimental infection has been obtained on *R. arborescens*, *R. austrinum*, *R. calendulaceum*, *R. nudiflorum*, *R. roseum*, *R. vaseyi*, *R. viscosum*, *R. carolinianum*, *R. catawbiense*, *R. indicum*, *R. japonicum*, *R. obtusum* var. *kaempferi*, *R. molle*, *R. yedoense* var. *poukhanense*, *Kalmia latifolia*, *Gaylussacia baccata*, *Vaccinium corymbosum*, *V. fuscatum*, and *V. tenellum*.

Four species of bumblebees (*Bombus americanorum*, *B. bimaculatus*, *B. impatiens*, and *B. separatus*), the solitary bee (*Emphoropsis floridana*), and the carpenter bees (*Xylocopa micans* and *X. virginica*) appeared to be the most important of the insects tested for the transmission of the pathogen from diseased to healthy plants. During the four-week period of most profuse blooming, an average of 20 per cent. of all the insects tested caused infection. Honeybees (*Apis mellifera*) and the two species of thrips frequenting azaleas, *Frankliniella tritici* and *Heterothrips azaleae*, transmitted the disease in a few trials only. The insects were observed to move from one azalea planting to another

several miles away; in one instance, moreover, *R. nudiflorum*, growing in woods half a mile away from cultivated azaleas and showing typical feeding punctures of *X. virginica*, was found to be infected.

In addition to the elimination of the insect vectors of the disease, indirectly by the provision of a succession of alternative flowering plants, and directly by the application of insecticides, important control measures against the flower spot are the destruction of diseased flowers to reduce the survival of sclerotia to a minimum and the removal of surface soil from round the base of infected plants after blossom fall, and its replacement with new earth or a thick leaf mulch. A copper-clay dust (5 to 6 per cent. metallic copper) should be useful in nurseries, but for ornamental plantings, where discoloration of the flowers must be avoided, a dilute acetic acid spray (1 in 750) should be substituted.

**Gardenia leaf spot caused by Rhizoctonia.**—*Flor. Rev.*, lxxxvi, 2217, p. 22, 1940. [Abs. in *Exp. Sta. Rec.*, lxxxiii, 5, p. 649, 1940.]

Preliminary studies are stated to have shown that the isolation of *Rhizoctonia* associated with an apparently new leaf spot of gardenia [in the United States] represents at least a new strain. A number of varieties proved susceptible to the fungus in inoculation experiments, but under natural conditions infection has largely been restricted to Pride of Daisy Hill. Control measures are indicated.

Yerkes (G. E.), Mulford (F. L.), McCulloch (Lucia), & Smith (F. F.). **Gardenia culture.**—*Leafl. U.S. Dep. Agric.* 199, 8 pp., 1 fig., 1940.

Popular notes on the following gardenia diseases and their control are included in this leaflet: chlorosis due to one of several adverse physiological factors, including iron deficiency (preventable by the admixture with the soil of ½ lb. sulphur per 100 sq. ft. or 1 lb. aluminium sulphate per 20 sq. ft.) and an unduly low soil temperature (below 70° F.); bud drop, also associated with unfavourable environmental conditions, e.g., extremes of soil temperature and moisture and poor illumination; stem canker (*Phomopsis gardeniae*) [*R.A.M.*, xx, p. 66], for the prevention of which the writers suggest spraying with 4-4-50 Bordeaux mixture or scattering 20 per cent. copper-lime dust or red copper oxide (cuprocide), 1 part in 100 of pure sand, round the crowns; foliar tipburn; [unspecified] leaf spots and sooty mould; brown leaf margins caused by lack of potash and amenable to control by the addition to the soil of 3 lb. potassium sulphate or potassium chloride per 100 sq. ft.; small, dark green leaves and short internodes, due to phosphorus shortage, which may be corrected by the incorporation with the soil of 5 to 25 lb. superphosphate per 100 sq. ft.; and sun scald following the action of strong sunlight on wet leaves.

Luttrell (E. S.). **Tar spot of American Holly.**—*Bull. Torrey bot. Cl.*, lxvii, 8, pp. 692–704, 16 figs., 1940.

American holly (*Ilex opaca*) in North Carolina, and probably throughout its range, is subject to infection by a tar spot of the foliage, characterized by the development in the early summer of reddish-

brown, yellow-bordered lesions, turning to a shining black and producing flat, pulvinate, subepidermal stromata in the autumn; during the winter these organs undergo gradual differentiation and in April the rupture of the outer epidermal layers exposes the orange-red apothecial disks 1 to 4 mm. in diameter. After dehiscence the surrounding leaf tissues succumb to desiccation, forming a buff-coloured necrotic area bearing the exhausted stroma and finally dropping out, leaving perforations. The infected leaves usually persist on the tree for the normal two-year period, but in severe cases death may occur by the end of the first year.

The fungus responsible for the disease, first designated *Rhytisma curtisii* B. & Rav. and later *Macroderma curtisii* (B. & Rav.) v. Höhn., is transferred, on the basis of its structural and morphological features, to the genus *Phacidium* as *P. curtisii* (B. & Rav.) Luttrell nov. comb. [with an emended Latin diagnosis]. The mycelium, entirely intracellular at first, subsequently forms a plectenchymatous stroma in the space vacated by the partially dissolved epidermal and adjacent mesophyll tissues. The clavate to cylindrical asci, 110 [given as 100 in the text] to 160 by 9 $\mu$, arise in the spring from a layer of filiform, simple paraphyses, 100 to 160 by 1·3 $\mu$, and contain eight fusoid to obovate, continuous, hyaline ascospores, 19 to 24 by 5 to 6 $\mu$, which germinate readily and produce short germ-tubes, but further growth in culture was not obtained.

WATSON (ALICE J.). **Celastrus scandens, a new host for Glomerella cingulata.**—*Plant Dis. Reptr*, xxiv, 19, pp. 385–386, 1940. [Mimeographed.]

Stems of *Celastrus scandens* from New Hampshire showed cankered areas almost girdling the circumference, about one inch in length, dull grey to brown on old stems, and reddish-brown with white centres on young, green ones. Typical *Gloeosporium* acervuli were found in the central portion of the lesions, and perithecia with mature ascospores in some of the older cankers. In both stages the fungus was morphologically typical of *Glomerella cingulata.*

When conidia from plate cultures were applied to scalpel wounds in McIntosh and Greening apples, typical bitter rot lesions rapidly developed.

FISCHER (G. W.). **Host specialization in the head smut of grasses, Ustilago bullata.**—*Phytopathology*, xxx, 12, pp. 991–1017, 2 figs., 1940.

This is a comprehensive, tabulated account of cross-inoculation experiments carried out from 1936 to 1939 with 44 collections of *Ustilago bullata* [*R.A.M.*, xix, p. 600] (comprising also *U. bromivora* and *U. lorentziana*) from 36 species of *Agropyron*, *Bromus*, *Elymus*, *Festuca*, *Hordeum*, and *Sitanion*. Eight physiologic races of *U. bullata* have been recognized on the basis of the reactions of the following fourteen differential species: *A. pauciflorum*, *B. brizaeformis*, *B. carinatus*, *B. catharticus*, *B. hordeaceus*, *B. japonicus*, *B. marginatus*, *B. mollis*, *B. secalinus*, *B. tectorum*, *E. canadensis*, *E. glaucus*, *E. sibiricus*, and

*H. nodosum*. It was found impossible to maintain the supposed specialization of the smut from species of *Agropyron* and *Hordeum* to members of the Hordeae, and that of species of *Bromus* to grasses of the same genus, certain collections from *Agropyron* and *Elymus* being pathogenic to *Bromus* spp., while some from the latter attacked *Agropyron*, *Elymus*, and *Hordeum* spp. Five of the eight races, in fact, number highly susceptible hosts both among the brome grasses and the Hordeae. The most common race (2), widespread in the Pacific North-West on *B. tectorum*, was found to be capable of attacking a number of species of *Agropyron*, *Elymus* (including the economic *E. glaucus*), and *Festuca*, besides a few other brome grasses, while another race (4), prevalent on *B. mollis*, is quite virulent on *E. canadensis*, likewise of economic importance.

The writer's previous proposal for the consolidation of *U. bromivora* and *U. lorentziana* with *U. bullata* [ibid., xvii, p. 45] is now fully substantiated by the inseparability of the three species even on a host specialization basis. Liro's proposed classification of each physiologic race as a distinct species [ibid., iii, p. 369] is not approved, and the eight new races of *U. bullata* are accordingly designated by numbers in accordance with current practice.

WILSON (M.), NOBLE (M[ARY]), & GRAY (E. G.). **Blind seed disease of Rye-Grass.**—*Nature, Lond.*, cxlvi, 3702, pp. 492–493, 1 fig., 1940.

Referring to Muskett and Calvert's recent communication on blind seed disease of rye grass [*Lolium perenne* and *L. multiflorum*: *R.A.M.*, xix, p. 709], the authors point out that in 1891 Prillieux and Delacroix (*Bull. Soc. mycol. Fr.*, vii, p. 116, 1891; viii, p. 22, 1892) described a parasite, *Endoconidium temulentum*, on rye, which had toxic properties. The genus *Endoconidium*, because of the endogenous formation of the microconidia, was based on this fungus, its perfect stage later being variously ascribed to *Phialea*, *Stromatinia*, and *Sclerotinia*. In the blind seed fungus [*Helotium* sp.] the authors also observed endogenous production of the microconidia; the measurements of the apothecia, ascospores, and microconidia closely agreed in both fungi, and, further, positive results followed inoculations of the flowers of rye with spores of the blind seed fungus. The only difference is that macroconidia have not been described in *Endoconidium*.

As many as three apothecia of the blind seed fungus were found on a [rye grass] caryopsis, which gave a normal seedling. Cultural experiments indicated that the systemic endophytes of *L. perenne* reported by McLennan, Sampson, and Neill [*R.A.M.*, xix, p. 477] may not be completely dissociated from one another or from the blind seed fungus. The results of the authors' investigations of the *Pullularia* sp. associated with the disease agreed with those of Muskett and Calvert [loc. cit.]. Apparently Gemmell described the blind seed fungus under the name *P. pullulans*.

With reference to Glasscock's work [ibid., xx, p. 22], the authors state that, in a recent test, of 19 rye grass seeds bearing conidia of the blind seed fungus 13 gave rise to normal plants. They conclude that neither the cause of the low germination of rye grass nor the identity of the associated fungi has yet been adequately investigated.

FILINGER (G. A.). **Combating fruit pests in Kansas.**—*Circ. Kans. agric. Exp. Sta.* 199, 44 pp., 21 figs., 1940.

This circular (a revision of No. 169 of the same Station by W. F. Pickett and G. A. Filinger) presents in a popular form much useful information on the following fruit diseases and their control in Kansas: apple blotch [*Phyllosticta solitaria*], apple scab [*Venturia inaequalis*], apple black rot or frog-eye [*Physalospora obtusa*], leaf curl and bacterial leaf spot of peach [*Taphrina deformans* and *Bacterium pruni*], brown rot of peaches, plums, and cherries [*Sclerotinia fructicola*], black rot of grapes [*Guignardia bidwellii*], cherry leaf spot [*Coccomyces hiemalis*], blister canker [*Nummularia discreta*], very injurious in Ben Davis, Gano, Missouri, and Winesap apple orchards, fireblight of apples and pears [*Erwinia amylovora*], cedar apple rust [*Gymnosporangium juniperi-virginianae*], plum black knot and plum pockets [*Dibotryon morbosum* and *T. pruni*], crown gall and orange rust of blackberries [*Bact. tumefaciens* and *Gymnoconia interstitialis*], and raspberry anthracnose [*Elsinoe veneta*]. Difficulty has been experienced in combating the last-named disease, but unpublished data from the Kansas Agricultural Experiment Station indicate that good results may be obtained by a dormant (early spring) application of 1 in 10 lime-sulphur, followed by another of the same mixture ($1\frac{1}{4}$ in 50) when the new shoots are 6 to 8 in. high. Spray schedules are also given for the other diseases amenable to this form of control, and a table shows the reaction to scab, blotch, frog-eye, cedar rust [*R.A.M.*, xix, p. 711], and fireblight of 17 apple varieties grown in the State.

BACKUS (E. J.) & KEITT (G. W.). **Some nuclear phenomena in Venturia inaequalis.**—*Bull. Torrey bot. Cl.*, lxvii, 9, pp. 765–770, 2 pl., 1940.

Details are given of a study at Wisconsin University on the development of the ascus and of nuclear phenomena in the vegetative mycelium, conidiophore, and conidium of *Venturia inaequalis*, the agent of apple scab [*R.A.M.*, xix, p. 547].

STAEHELIN (M.) & BOVEY (P). **La lutte contre la carpocapse et la tavelure des Pommiers et Poiriers, en Suisse romande. Observations et essais effectuées de 1933-1938.** [The campaign against the codling moth and scab of Apple and Pear trees in Romansh Switzerland. Observations and experiments carried out from 1933 to 1938.]—*Annu. agric. Suisse,* xli, 6, pp. 635–680, 3 figs., 5 graphs, 1940.

This is a fully detailed, tabulated survey of experiments carried out over a six-year period in different localities of Romansh Switzerland to determine the most effective methods of combating the apple codling moth (*Laspeyresia* [*Cydia*] *pomonella*) and apple and pear scab (*Venturia inaequalis* and *V. pirina*) [*R.A.M.*, xix, p. 263]. In a general way, the results confirmed those of previous years in emphasizing the great importance of the pre- and post-blossom sprays for scab control, as well as of a late treatment for the prevention of infection in storage [ibid., xix, p. 710]. Preparations with a copper base (oxychlorides or carbonates) should be used for the pre-blossom and late applications, while the second and third post-flowering treatments may be made with

lime-sulphur. In the three last years of the trials the 'blue' spray (5 to 6 per cent. Bordeaux mixture, applied in the very early spring, just before the trees come into leaf) was included in the experimental programme. In 1936, a favourable season for scab development, this single treatment gave equal or slightly superior control to the usual schedule of five to six applications, but in 1937 and 1938 the 'blue' spray, either alone or combined with soluble carbolineum, as used during the dormant period, was less effective than the normal programme, even when supplemented by summer treatments.

Valleau (W. D.). **Origin of outbreaks of Peach leaf curl.**—*Plant Dis. Reptr*, xxiv, 17, p. 354, 1940. [Mimeographed.]

The author points out that a study of the literature of the subject indicates that the ascospores of *Taphrina deformans* [*R.A.M.*, xix, p. 549] germinate soon after, and frequently before, their release. They then form a yeast-like colony on the bark of the tree, which is the source of infection a year later, and not the ascospores, as is often assumed. If it is recognized that a saprophytic gametophyte stage lives as a yeast-like fungus on the trees at all times, and that after a cool, wet spring the parasitic sporophytic stage develops in the leaves, then sudden outbreaks of infection in damp, cool years in areas where the disease was not known before, easily become explicable, without any need to assume that the ascospores have been carried over from a previous year or blown in from another locality. Further, late infections on growing point leaves on new shoots a foot or more long, occurring during a cool, wet period late in the spring, are explained without the necessity of assuming secondary infection.

**Ministry of Agriculture and Fisheries, England and Wales. Register of growers of certified Strawberry plants, 1940.**—2 pp., 1940. [Mimeographed.]

Section I of this register contains an alphabetical list of growers, with their addresses and certificate numbers, of strawberry plants certified as true to variety, attaining a standard of purity of not less than 99·5 per cent., and reasonably free from pests and diseases, while II is arranged under varieties (13), the names of growers and the acreages of their certified stocks being given under each.

Müller (A. S.). **Un estudio preliminar sobre el control de la roya de la Higuera.** [A preliminary study on the control of Fig rust.]—*Agricultor venez.*, iv, 49, pp. 35–37, 2 figs., 1940.

Severe attacks of fig rust (*Cerotelium fici*) having been observed to limit the successful large-scale production of the fruit in the Caracas district of Venezuela, the writer carried out a series of experiments in the control of the disease by dusting, a method regarded as preferable to the standard recommendation of 1 per cent. Bordeaux mixture, with which complete coverage of the lower leaf surfaces is stated not to be easily effected. The treatment was carried out on five one-year-old trees each of the Lemon and Brunswick varieties, a total of seven applications being made at 15-day intervals with the Niagara dusting apparatus with a capacity of 5 kg. of dust. The following results were

obtained. The treated Lemon and Brunswick trees (ten branches of three of each group) bore 36 healthy leaves each compared with 27 and 28, respectively, in the controls; 204 and 183 leaves with few pustules (19 and 30, respectively); 25 and 1 with dry areas (44 and 60, respectively); and fallen 8 and 2 (217 and 139, respectively).

Kébreau (F.). **La maladie de Sigatoka et le mal de Panama.** [Sigatoka and Panama diseases.]—*ex* **Compte rendu du premier Congrès des Agronomes et Spécialistes du Service National de la Production Agricole et de l'Enseignement Rural.** [Proceedings of the first Congress of Agronomists and Specialists of the National Service of Agricultural Production and Rural Instruction.]—*Bull. Serv. nat. Prod. agric. Haiti* 16, pp. 14–31, 1 fig., [? 1940. Received January, 1941].

A full account is given of the available information concerning the Sigatoka and Panama diseases of bananas (*Cercospora musae* and *Fusarium* [*oxysporum*] var. *cubense*), with special reference to their distribution and pathogenicity in Haiti [*R.A.M.*, xviii, p. 327], where the former was first observed by the writer in November, 1937, at the Damien Experiment Farm, and at about the same time by members of the Standard Fruit Company in two localities at opposite points of the Republic, namely, Carrefour-Dufort (Léogane) and Carrefour Jean Bernard (Grand Rivière du Nord). *C. musae* is stated to be advançing rapidly through the banana-growing regions of the country, assuming an epidemic form at Damien in the rainy season from August to October. Attempts at the cultivation of Cavendish and Gros Michel bananas in low-lying sites where mists are prevalent should be definitely abandoned. Panama disease is also most injurious in districts with a high rainfall and in excessively damp, poorly aerated soils.

**British Honduras. Report of the Department of Agriculture for the year 1939.**—20 pp., 1940.

The following references to banana leaf spot (*Cercospora musae*) [*R.A.M.*, xvi, p. 195] occur on pp. 1 and 4 of this report. The increasing damage caused by the disease has been an important factor in the rejection of a large proportion of the fruit presented for shipment. The response of growers to an experimental scheme for the control of the pathogen by fungicidal treatment was, in general, not enthusiastic, partly on account of the very poor returns at present being obtained for the banana crop, but a few of those owning extensive plantings on superior types of soil have commenced spraying operations, using small mule-drawn power sprayers with a pressure of 250 to 300 lb. per sq. in. In 1939 the reduction in exports from the Toledo district was 24 per cent. of the 1938 output in quantity and 40 per cent. in value; the decline of production in the Stann Creek Valley was even sharper, the yield being only half that secured in 1938.

Magee (C. J.). **Banana leaf spot. Spraying and dusting trials, 1939-40.**—*Agric. Gaz. N.S.W.*, li, 10, pp. 555–558, 1 fig., 1940.

In further spraying tests carried out in New South Wales during 1939–40, satisfactory control of banana leaf spot (*Cercospora* [*musae*: *R.A.M.*, xix, p. 106]) was obtained on all sprayed plots

by three to five applications, from 5th December to 3rd April, of a mixture consisting of $1\frac{1}{2}$ lb. copper oxychloride, $1\frac{1}{2}$ lb. colloidal sulphur (against insect infestation), and wetsit dispersing agent 2·4 fl. oz. in 40 gals. of water, or copper oxychloride and wetsit at the same concentrations, with $\frac{1}{2}$ gal. white oil in 40 gals. of water, or with the first formula, but with basic copper sulphate instead of copper oxychloride. The colloidal sulphur and white oil were included with the object of controlling red spider (*Tetranychus telarius*) and mite (*Phyllocoptes* sp.), which can cause much foliage injury in seasons with prolonged dry periods. The rate of application approximated to 80 gals. per acre at full foliage, and the sprays were applied at a pressure of 150 lb. per sq. in. through a fine disk nozzle. The spray was directed to the under side of the two youngest expanded leaves and the heart leaf at the first application and subsequently to all new leaves. Two plots (with four and five applications, respectively) were outstanding in amount of foliage and absence of infection, probably because some of the treatments synchronized with the chief periods of infection, 26th to 28th October, 31st January to 3rd February, and 29th February to 4th March. It appears at least likely that sprays applied shortly after a spell of weather favourable to infection may prevent an outbreak. If rain interrupts spraying it should be resumed directly the weather permits.

Satisfactory control also followed five applications of a dust containing 20 per cent. basic copper sulphate, 40 per cent. sulphur, 30 per cent. hydrated lime, and 10 per cent. kaolin. Dusting, however, is laborious, unpleasant, and is unlikely to become popular, even with the small proprietor, especially as it has been found that the type of knapsack sprayer operated by a pump in the spray rod is less tiring that the old types.

The present tentative recommendation of spraying at monthly intervals from early December to March is adhered to.

The practical difficulties of applying sprays in plantations on boulder-strewn slopes have been overcome by the collection of water in iron drums conveniently placed throughout the plantation, using a sheet of iron as a catchment, or by the construction of small dams in plantations where springs occur. The sprays may be applied by means of a bucket pump but some growers have installed stationary spray plants and others use portable power sprayers.

During 1939–40 the first period of leaf spot weather occurred from 26th to 28th October and it was observed that a far greater amount of infection occurred in stools where a bunch subtended by infected foliage from the previous season was present. Sometimes the influence extended to two or three stools and it is probable that the beneficial effect of spraying will be cumulative. The observation also explains why the disease is rarely important in young plantations. It is proposed in the 1940–41 trials to apply the first spray early in October after the plants have been stripped of all spotted foliage that can be spared.

**Enfermedades de las Aguacates.** [Avocado diseases.]—*Agricultor venez.*, iv, 49, p. 47, 1940.

*Diplodia cacaoicola* [usually regarded as identical with *Botryodiplodia theobromae* and various other species: *R.A.M.*, xviii, p. 788] was isolated

in pure culture from the cortical tissues of dying avocado trees situated in hard, compact, dry soil in the Guarenas (Miranda) district of Venezuela, and is believed to have been a contributory factor in the trouble. Cacao trees in the vicinity doubtless constituted a focus of infection. Since the fungus enters its hosts through wounds, the practice of cutting the bark with a knife should be discontinued. All infected material should be removed and the trees liberally supplied with water, drainage being provided where necessary.

HENRY (B. W.) & WAGNER (ELIZABETH C.). **A rapid method of testing the effects of fungicides on fungi in culture.**—*Phytopathology*, xxx, 12, pp. 1047–1049, 1 fig., 1940.

The writers' method of testing the efficacy of fungicidal dusts consists essentially in the application of the test material either as a dust or a spray, by methods which are described in detail, to half of a Petri dish culture containing a central colony 2·5 to 3 cm. in diameter. The plates are then incubated at the optimum temperature for the fungus under investigation (*Diplodia zeae* in the authors' experiments) for the period normally required to attain a diameter of 8·5 to 9 cm. If the fungicide is effective, the growth of the mycelium proceeds in the ordinary way on the untreated section of the plate, but is inhibited on the dusted or sprayed half.

FERNANDO (M.). **The incidence of plant disease in Ceylon in relation to environmental factors.**—*Trop. Agriculturist*, xcv, 2, pp. 72–78, 1940.

The author points out that resistance to fungal and bacterial disease in plants is by no means uniformly correlated with plant vigour, though instances of parallelism do exist. In Ceylon humidity is the chief environmental factor conditioning plant disease. Citrus canker (*Pseudomonas citri*) and bacterial wilt (*Bacillus* [*Bacterium*] *solanacearum*) of Solanaceous plants are major problems only in the wet part. Panama disease of plantains (*Fusarium oxysporum* [var. *cubense*]) is severest in damp, low-lying areas subject to frequent flooding. Sclerotial diseases of rice (*Sclerotium oryzae* [? *Leptosphaeria salvinii*] and *Rhizoctonia* [*Corticium*] *solani*) are particularly virulent in swampy land. *Thielaviopsis* [*Ceratostomella*] *paradoxa* becomes epiphytotic on pineapples planted in badly drained soil. The effects of light are closely associated with those of humidity, humid conditions under shade favouring spore germination and growth; temperature conditions, however, are almost everywhere and in all seasons favourable to infection. Both soil texture and soil reaction may be important factors, for example, root rot (*Fomes lucidus*) [*Ganoderma lucidum*] of coco-nuts and brown root (*F. noxius*) of tea and rubber being particularly damaging on light soils, whereas *Sphaerostilbe repens* is most virulent to papaw and other plants on heavy, poorly aerated soils. Fertilizers also affect disease incidence: data are given showing that a single application of nitrogenous fertilizer with potash and superphosphate to cotton at Maho produced significant increases in the incidence of sore shin (*R.* [*C.*] *solani*). The severity of this disease appeared to increase *pari passu* with the amounts of artificials used.

*Botryodiplodia theobromae* is usually regarded as a saprophyte, but the fungus can attack tea depleted of the starch reserves in the roots by too frequent picking or too brief a pruning cycle. Generally speaking, influences reducing host vigour stimulate the development of facultative parasites, including wound parasites, whereas in the case of obligate parasites resistance frequently falls as host vigour increases and vice versa.

Perotti (R.). **Biologia vegetale applicata all' agricoltura. III, Micologia —malattie parassitarie.** [Plant biology applied to agriculture. III, Mycology—parasitic diseases.]—x+[2]+1191 pp., 401 figs., Turin, Rosenberg & Sellier, 1940. [Abs. in *Exp. Sta. Rec.*, lxxxiii, 5, p. 636, 1940.]

This instalment of a five-volume work on the biology of crop plants treats in the first place of general questions relating to parasitic diseases, including morbid anatomy, and then discusses specific diseases, arranged according to their etiological agents under the headings of bacteria, viruses, Myxomycetes, and the various groups of true fungi. The volume terminates with a section on immunity in plants and general control measures, author and subject indexes being appended.

Setterstrom (C.). **Effects of sulphur dioxide on plants and animals.**—*Industr. Engng Chem.*, xxxii, pp. 473–479, 3 figs., 2 graphs, 1940.

In this paper the author briefly reviews the results obtained in three years' investigations carried out at the Boyce Thompson Institute, New York, in collaboration with P. W. Zimmerman, W. J. Youden, A. Hartzell, W. Crocker, and F. R. Weedon, into the effects on plants and animals of exposure to low concentrations of sulphur dioxide [*R.A.M.*, xviii, p. 467; xix, p. 34]. The apparatus used in the study is described in detail and a bibliography of 43 titles is appended.

Rigler (N. E.) & Greathouse (G. A.). **An automatic zero pipette for dispensing sterile culture media.**—*Science*, N.S., xcii, 2390, pp. 363–364, 1 fig., 1940.

A description is given of an automatic zero pipette, similar to those commercially available but made in Pyrex glass and specially adapted for sterilizing and aseptically dispensing measured quantities of liquid culture media into sterile flasks.

Grainger (J.). **Virus and vital organization.**—*Nature, Lond.*, cxlvi, 3704, pp. 539–541, 3 graphs, 1 diag., 1940.

In this paper the author adduces evidence in support of the view that a virus is a living entity, since it exhibits a type of independent movement through the host that can only be interpreted as autonomous, and is also independent of the host in its temperature relations.

Schopfer (W. H.) & Blumer (S.). **Recherches sur la répartition de l'hétérotrophie par rapport à l'aneurine chez les champignons.** [Studies on the distribution of heterotrophy in relation to aneurin among the fungi.]—*Arch. Mikrobiol.*, xi, 2, pp. 205–214, 2 figs., 1940.

Further particulars are given of the authors' studies at the Berne

Botanical Institute on the aneurin requirements of representatives of various groups of fungi [*R.A.M.*, xix, p. 562]. Of the Polyporaceae included in the investigations none was absolutely dependent on aneurin (the complete molecule of vitamin $B^1$), *Polyporus adustus* thriving in the presence of pyrimidin alone, *P. squamosus*, *P.* [*Polystictus*] *zonatus 2 ab*, and *Hypholoma fasciculare* developing about equally well with pyrimidin plus thiazol and aneurin, *Polyporus* [*Polystictus*] *abietinus*, *P. zonatus 7* $a^1b^1$, and *Polyporus benzoinus* better with the two aneurin constituents than with $B^1$ itself, while *Polystictus versicolor* responded more favourably to aneurin.

Among the Ustilagineae *Tilletia levis* [*T. foetens*] was found to be auxo-autotrophic, *T. tritici* [*T. caries*] did not appear to require aneurin to the extent indicated by Défago [ibid., xix, p. 644], growing only slightly better with than without growth factors, while *T. horrida* [ibid., xviii, p. 711] developed most profusely in the presence of pyrimidin plus thiazole (57·6 mg.), followed by aneurin (50·2), compared with 1·4 mg. for the control.

*Septoria apii* also grew best in the presence of pyrimidin plus thiazole, followed by aneurin (135·5 and 134·9 mg., respectively), the corresponding figures for pyrimidin alone and the control being 58·8 and 8·1 mg., respectively. *Mycosphaerella grossulariae* proved to be auxo-heterotrophic in respect of aneurin or a combination of its two components.

*Torulopsis candida* (Fungi imperfecti), as already shown by Rennerfelt [ibid., xviii, p. 198], is favoured by the presence of *Penicillium rugulosum* in mixed cultures and fails to react to aneurin. *Pericystis apis* (Endomycetales) [ibid., xvi, p. 673] also gave evidence of marked auxo-heterotrophy and indifference to aneurin. The indispensable growth factors for *T. candida* and *P. apis* are contained in completely hydrosoluble, concentrated yeast extracts, of which Hoffmann-La Roche's was the most effective of the three tested.

Tamargo (M. A.). **A study of seedlings and varieties of the Irish Potato in Cuba.**—*Amer. Potato J.*, xvii, 12, pp. 323–327, 1940.

Three years' observations at the Agricultural Experiment Station, Santiago de las Vegas, Cuba, showed that most of the potato seedlings and varieties introduced for trial purposes tended to lose their native vigour in their new environment on account of climatic influences (short days) and virus diseases (notwithstanding drastic roguing). Some resistance to mosaic was shown by Alma, Hindenburg, Odenwälder Blaue, and Weltwunder, while Duke of York, Gloria, Hetman, and Jubel were highly susceptible. Carnea and Ackersegen showed a certain amount of silver scurf [*Spondylocladium atrovirens*], but these two varieties were the most resistant to blight (*Phytophthora*) [*infestans*], followed by Ovalgelbe, Henderson, and Gloria; Centifolia, Bintje, Rosafolia, Allerfrüheste Gelbe, Jubel, Odenwälder Blaue, Royal Kidney, Hetman, Weltwunder, and Duke of York were very susceptible.

Reddick (D.). **Problems in breeding for disease resistance.**—*Chron. bot.*, vi, 4, pp. 74–77, 1940.

Twenty years ago the author formed the opinion that potato blight

(*Phytophthora infestans*) was the type of disease requiring a permanent scheme of control, justifying a substantial expenditure of time and money, and the development of the situation during the interim has in no way modified his views. An interesting survey is given of the history of the fungus [*R.A.M.*, xix, p. 300], and of the attempts to date to breed resistant potatoes by crossing certain wild Mexican species of *Solanum*, notably *S. demissum*, a collective species comprising mostly immune forms, with commercial varieties [ibid., xix, pp. 40, 490]. The first record of the fungus in South America is that of Lagerheim in 1891 and the author considers it was introduced into this region on the European potato. There are now extant four physiologic races of *P. infestans* in North America, ranging in virulence from the level attained on Green Mountain through President through KB/5 to AAB/2, the two last-named representing groups of hybrids. The virulence of *P. infestans* is enhanced by passage through a resistant host such as President, and it is possible that an almost infinite range of races would develop if suitable intermediates were produced, and that by such a process the immunity of the original wild parent might ultimately be broken down. Bearing in mind the fact that the pathogen, once raised to a given level of virulence, remains at that degree of intensity for at least 20 passages on any variety, the wisdom will be apparent of the present practices of inoculating all new seedlings with the most virulent culture obtainable, destroying all reactors, and endeavouring to eliminate the President variety as inimical to potato cultivation in North America.

Coates (W. H.). **The influence of a three-year rotation and fertilizer treatments on the organic carbon of soils.** *ex* **Experiment with Potatoes.**—*Bull. N.H. agric. Exp. Sta.* 324, pp. 19–25, 1 graph, 1940.

In connexion with a study on the effects of various fertilizer treatments and a triennial rotation on the organic carbon level of New Hampshire soils, experiments were carried out in the control of potato scab [*Actinomyces scabies*] on limed plots by the admixture with the soil of aluminium sulphate (200 to 900 lb. per acre) or sulphur (200 to 600 lb.). Although both substances reduced the incidence of infection, in no case was perfect control obtained, and in view of their high cost, growers would probably be better advised to plough under green manure crops or apply sulphate of ammonia broadcast to achieve comparable results.

Severin (H. H. P.). **Potato naturally infected with California Aster yellows.**—*Phytopathology*, xxx, 12, pp. 1049–1051, 1 fig., 1940.

A volunteer potato plant was collected in the Montana Mountains in 1936 with purple, sessile aerial tubers growing from the leaf axils, and in turn giving rise to purple, dwarfed foliage. Two lots of 20 previously non-infective long-winged aster leafhoppers (*Macrosteles divisus* = *Cicadula divisa*), a newly discovered vector of the aster yellows virus present in the locality in question, conveyed the typical symptoms of aster [*Callistephus chinensis*] yellows from the diseased potato to two healthy aster plants after an average feeding period of four days,

showing that the potato was naturally infected by the California aster yellows virus [*R.A.M.*, xiv, p. 312].

Eight potato plants with aerial tubers suffering from psyllid yellows and bearing the insect causing this disease, *Paratrioza cockerelli* [ibid., xiv, p. 117] neither acted as reservoirs of the aster yellows virus, judging by the negative outcome of transmission experiments with the long-winged leafhopper, nor did psyllid yellows develop in their progeny by way of the tubers.

SAMUEL (G.). **Potato planting in relation to health certification.**—*J. Minist. Agric.*, xlvii, 3, pp. 166–172, 9 figs., 1940.

Certificates issued by the Ministry of Agriculture and Fisheries after inspection of growing crops of potatoes in England and Wales now take into consideration the health as well as the purity of the crops, which have to comply with two conditions, viz. (1) the seed planted must be Class I (Scotch) with S.S., T.S.(A), T.S.(H), N.I.(A), or N.I.(H) certificate, Class I (Irish), Class I (English Special Stock), or Class I (Welsh Special Stock), and (2) the crop must be grown at least 50 yards away from any other potatoes not eligible for entry under (1). These conditions are intended to ensure that the stock is of a good standard of health, and is grown in some degree of isolation from outside sources of infection. It is emphasized that the aim of the English scheme is to indicate those stocks that are likely to have maintained their health to a satisfactory extent during their first year of growth for ware production. It is essentially different from the Scotch, Irish, Welsh, or English special stock schemes which are concerned only with producing healthy seed.

The author briefly summarizes the chief factors affecting the health of seed potatoes in England and discusses the spread of virus diseases within the crop and spread into a crop from outside sources. A good instance of the latter was observed in Kent in 1938 when leaf roll spread from one corner of a field, the source of infection possibly being an adjacent *Brassica* crop that had been cleaned up soon after the potatoes had been planted. Similar spread of leaf drop streak [potato virus Y] has also been observed. He considers that it is preferable not to plant potatoes adjacent to an overwintered *Brassica* crop. The destruction of the haulm before the time of natural dying down makes for more healthy seed but, except in blight [*Phytophthora infestans*] years it probably reduces ware production too much to be considered. The paper concludes with notes on examples of good and poor planting arrangements met with during the year.

**Ministry of Agriculture and Fisheries, England and Wales. Register of certified stocks of Potatoes 1940.**—55 pp., 1940. [Mimeographed.]

This register is divided into two parts, I (immune varieties) and II (non-immune), showing in alphabetical order the varieties, names and addresses of the growers or other certificate-holders and the acreage certified in respect of purity of stock and freedom from severe virus diseases and wildings [see preceding abstract].

RYKER (T. C.) & JODON (N. E.). **Inheritance of resistance to Cercospora oryzae in Rice.**—*Phytopathology*, xxx, 12, pp. 1041–1047, 2 figs., 1940.

During the growing seasons of 1936 and 1937, the following crosses were made at the Louisiana Agricultural Experiment Station between rice varieties resistant or susceptible to *Cercospora oryzae* [*R.A.M.*, xix, p. 301] and their progenies subsequently tested for reaction to the pathogen in the field and greenhouse: Fortuna (highly resistant) × Blue Rose (susceptible), C.I.461 × Early Prolific (same combination), C.I.461 × Blue Rose, Blue Rose × C.I.4440 (highly resistant) and reciprocally, and C.I.4440 × selection 283 A–10–1–1–3 (from the susceptible Edith × Fortuna). The $F_1$ offspring of all these crosses showed resistance to the leaf spot, while the $F_2$ (with the exception of C.I.4440 × selection 283 A–10–1–1–3, which largely escaped natural infection and was not artificially inoculated) segregated into resistant and susceptible populations on the 3:1 ratio anticipated on the basis of single pair of genes controlling resistance. The $F_3$ progenies of four of the crosses (omitting the anomalous C.I.4440 × selection) behaved according to expectation on the assumption that resistance is due to a single dominant factor.

SOESMAN (J. G.). **Tapvlakziekten en tapvlakbehandeling van Hevea brasiliensis.** [Tapping surface diseases of *Hevea brasiliensis* and the treatment of the tapping surface.]—*Bergcultures*, xiv, 41, pp. 1305–1311, 2 graphs, 1940.

Referring to Heubel's recent survey of the various methods practised in the Dutch East Indies for the control of diseases of the tapping surface of *Hevea* rubber [*R.A.M.*, xix, p. 726 and next abstract], the writer describes the results obtained by the application, under the direction of the Besoeki (Java) Experimental Station, of different modifications of the tapping system and treatment of the tapping surface in relation to production in a plantation situated 500 to 800 m. above sea-level, with an annual rainfall of 4,400 mm. The success achieved in the eradication of stripe canker (*Phytophthora faberi*) [*P. palmivora*] from 1933 to 1937 by a conservative system of tapping, antiseptic treatment of the tapping surface, and plantation hygiene was fully maintained in subsequent seasons [ibid., xvi, p. 772], cost of control being reduced in 1937 and 1939 to 14 and 7 per cent., respectively, of that obtaining in 1934. Similar measures are applicable to the control of mouldy rot [*Ceratostomella fimbriata*].

MULDER. **Tapvlakziekten en tapvlakziektenbehandeling van Hevea brasiliensis.** [Tapping surface diseases of *Hevea brasiliensis* and their treatment.]—*Bergcultures*, xiv, 43, pp. 1368–1372, 1940.

Heubel's recommendations for the control of stripe canker [*Phytophthora palmivora*] and other diseases of the tapping surface of *Hevea* rubber [see preceding abstract] are discussed in the light of the writer's personal experience in Java, and considered to be open to criticism on certain points, notably in the failure to lay sufficient stress on the need for the preventive, as opposed to curative, treatment of infection in humid localities.

MEREDITH (C. H.). **A quick method of isolating certain Phycomycetous fungi from the soil.**—*Phytopathology*, xxx, 12, pp. 1055–1056, 1940.

The following technique has proved convenient and effective in the isolation of seedling- and root-rotting Phycomycetes from Iowa soils. The mouth of a sterile test-tube is thrust vertically to a depth of about 1 in. into the soil, withdrawn, and the plug reinserted. In the laboratory a small quantity of the soil is spread over the surface of a flamed cover glass, over which a Petri dish containing 2 per cent. nutrient-free agar is inverted and lowered until the uppermost soil touches and adheres to the agar surface. The dish is covered while inverted and incubated at 20° to 25° C. Single hyphal tips usually appear at the edge of the soil in 24 to 48 hours, and are transferred to plain agar in another dish. Pure cultures are frequently obtained immediately by this method, but when bacterial contamination occurs a small portion of the culture is transferred to the under side of maize meal, oatmeal or plain agar in another dish, a V-shaped slit being cut in the agar for this purpose. The fungus usually grows up through the agar in 24 to 48 hours and can then be transferred in a pure state to a suitable medium.

*Pythium de Baryanum* having been observed to be less prevalent in the surface soil of lucerne plantings during mid- or late summer after a protracted dry, hot spell than during a period of moderate temperature and plentiful moisture, isolations were made by the foregoing method in 1936 and 1937 to determine the extent of the Phycomycetous soil population at different dates. In April and May, 1936, loam soils yielded cultures of *P. de Baryanum*, *P. ultimum*, *P. rostratum*, *P. echinulatum*, *P. pulchrum*, and *P. vexans*, while among the 50 isolates from silt loams in March, 1937, were 21 of *P. de Baryanum*, 9 of *P. pulchrum*, and 7 of *P. rostratum*, the remainder being unidentified Phycomycetes. Of 10 strains obtained from a silty clay loam maize field in July, 1937, six were *P. rostratum*, three unidentified Phycomycetes, and one a species of *Fusarium*. *P. ultimum* was the only Phycomycete among 50 organisms isolated from loam, silt loam, and silty clay loam maize field soils from 23rd to 27th July, 1937.

It is apparent from these data that *P.* spp. are predominant in Iowa soils in the spring and rare in late July.

RANGASWAMI IYENGAR (R. S. S.) & GRIFFITH (A. L.). **Entomological investigations on the spike disease of Sandal (35). Further studies on the spike disease of Sandal.**—*Indian For. Rec.*, N.S., Entom., vi, 4, pp. 86–196, 12 pl., 1940.

Further extensive experiments in Madras on the insect transmission of sandal spike [*R.A.M.*, xviii, p. 818] indicated that the vector is active in this direction during the night at two seasons of the year, namely, March to April and August to November. The difficulty of obtaining positive results in cages suggests the intervention of an uncommon species: suspicious symptoms have been induced by *Moonia albimaculata*, *Nezara viridula*, *Jassus indicus*, and *Coccosterphus tuberculatus*, and one of these may very likely be concerned in the conveyance of infection from diseased to healthy trees. No analogous symptoms have so far been transmitted by leaf-grafting (the most

effective of the various methods tested). One month's exposure was found to suffice for the development of infection.

The criteria for the presence of the disease should be (*a*) the typical symptoms of stiff, straight, bristly leaves, becoming progressively smaller, narrower, more pointed, and fewer, and failure to produce flowers or fruit; (*b*) the transmission of infection to healthy plants by leaf-grafting; and (*c*) the death of the tree within a period of two to three years. Lack of attention to these three essential points has been responsible for unreliable claims to the discovery of the insect vector, especially as morphological symptoms of the disease have been induced by factors other than the virus itself, namely, mass-feeding of insects, sickliness of the host plant, and associating the sandal with certain species of host plant (e.g., *Pithecolobium* [*Samanea*] *saman*).

Artificial defoliation was found to force out the expression of spike symptoms in 'masked' trees, which have been shown to constitute sources of infection, and has proved very useful in control operations in the forest, as well as in saving time in experimental work.

The average time elapsing between the inception of spike infection and its external manifestation is roughly 7 and 4½ months under natural and artificial conditions, respectively, and the average period from the appearance of symptoms to the death of the tree about 15 months, varying with girth.

The copious experimental data secured by the authors are presented in tabular form in appendixes A, B, C, D, and F. Appendix E is a summary by N. C. Chatterjee of the fauna caught on sticky papers.

WIEHE (P. O.). **L'influence de la saison et des engrais potassiques sur le développement du 'eye spot' de la Canne à Sucre.** [The influence of the season and of potassium fertilizers on the development of 'eye spot' of Sugar-Cane.]—*Rev. agric. Maurice,* xix, 2, pp. 57–61, 3 graphs, 1940.

On the high plateaux of Mauritius the lesions produced on sugar-cane leaves by *Helminthosporium ocellum* [*H. sacchari : R.A.M.*, xvii, p. 487] increase progressively in number and size from April onwards until they reach a maximum in September or October, after which they cease to appear in the hot season. Records made in a field of BH 10/12 sugar-cane at Cascade (altitude 1,100 ft., annual rainfall 125 in.) showed that on 8th December, 6th February, 20th April, 7th August, and 12th October (1938–9) the average infection of the leaf area, as determined by an arbitrary scale, was, respectively, 7·5, 3·2, 9·8, 18·5, and 20·9 per cent. The apical part of the leaf was that most seriously affected and the lesions spread most quickly in the cold months. The average monthly temperatures in the locality concerned in 1938–9 were, December 22·2° C., February 24·1°, April 22·7°, August 16·9°, and October 19·4° and the effect of temperature on the progress of infection was clearly demonstrated. Some varieties, including resistant ones, became attacked in winter [ibid., vii, p. 200].

Other observations (from December to October) on leaves of the same variety growing in plots receiving complete fertilizer and plots given equivalent amounts of nitrogen and phosphoric acid, but no potassium, showed that average infection was 12 and 9·6 per cent., respectively.

LUTHRA (J. C.), SATTAR (A.), & SANDHU (S. S.). **Experiments on the control of smut of Sugarcane (Ustilago scitaminea Syd.).**—*Proc. Indian Acad. Sci.*, Sect. B, xii, 4, pp. 118–128, 1940.

The following measures were found to be effective in the control of sugar-cane smut (*Ustilago scitaminea*) in recent experiments at Lyallpur and Risalewala, Punjab [*R.A.M.*, xvii, p. 501]: the use of clean setts for planting; disinfection of setts by five minutes' immersion either in 0·1 per cent. mercuric chloride or 1 per cent. formalin (followed in the latter case by two hours' covering with a damp cloth); the immediate roguing of smutted plants; and discouraging growers from ratooning diseased crops. Both the chemical treatments completely eliminated infection without adverse effects on germination or yield, whereas the percentage smut infection in the controls inoculated by smearing the buds of the setts with spores at planting was 13·8 in the 1936 experiment and 19·7 in that of 1937, other controls similarly inoculated but dipped in water for 5 minutes before planting showing 24·4 and 36·1 per cent., respectively.

LUTHRA (J. C.), SATTAR (A.), & SANDHU (S. S.). **Some studies on the physiology of Cytospora sacchari Butl., the causal fungus of stem canker disease of Sugarcane.**—*Proc. Indian Acad. Sci.*, Sect. B, xii, 4, pp. 172–188, 9 graphs, 1940.

Continuing their studies at the Punjab Agricultural College on *Cytospora sacchari* [*R.A.M.*, xviii, p. 139], the writers found raw sugar, oatmeal, and Richards's agar more conducive to the linear growth of the fungus than Brown's agar, with or without starch, normal and double-strength Richards's promoting the maximum development. Growth declined as a result of the omission of sucrose from Richards's agar, or its replacement by glucose or lactose; maltose, on the other hand, served equally well as sucrose as a nutrient. Maximum growth was attained in media containing sucrose at the rate of 200 gm. per l. The development of *C. sacchari* was not materially affected by the exclusion from the substratum of potassium nitrate, potassium dihydrogen phosphate, or magnesium sulphate, provided the hydrogen-ion concentration was adjusted to $P_H$ 5. The minimum, optimum, and maximum temperatures for the growth of the pathogen were found to be below 15°, 30°, and 35° to 40° C., respectively. The fungus developed most profusely at $P_H$ 3·8, growth ceasing at 1·8 and 7·8 on the acid and alkaline sides, respectively. These observations have an important practical bearing on sugar-cane cultivation in the Punjab, where most of the soils are too alkaline ($P_H$ 7 to 8·5) to support the parasite, thereby eliminating the possibility of infection from this source. During a 35-day period pycnidia were formed on the raw sugar media and oatmeal only, their numbers being directly proportional to the concentration of the oatmeal medium ($\frac{1}{8}$ to 4 times normal in the experiments described) and to the amount of sucrose added. The addition of maltose to Richards's agar induced pycnidial formation, and light was another favouring factor in the development of these organs.

WEHMEYER (L. E.). **Contributions to a study of the fungus flora of Nova Scotia. V. Discomycetes.**—*Canad. J. Res.*, Sect. C, xviii, 11, pp. 535–549, 1 pl., 6 figs., 1940.

Continuing his studies on the fungus flora of Nova Scotia [*R.A.M.*,

xix, p. 433], the author gives an annotated list of 138 Discomycetes found in that region.

COOKE (W. B.). **Preliminary host index to fungi of Mount Shasta, California.**—*Plant Dis. Reptr, Suppl.* 123, pp. 125–133, 1940. [Mimeographed.]

A list is given of the fungi observed by the writer during the summers of 1937, 1938, and 1939 on trees and other plants on the south-west slopes of the volcanic Mount Shasta, California. Several of the rusts and smuts are claimed to be new records for the State.

IMAZEKI (R.). **Observations on Japanese fungi (V.)**—*J. Jap. Bot.*, xvi, 10, pp. 583–591, 9 figs., 1940.

This is a critically annotated list [cf. *R.A.M.*, xix, pp. 119, 238] of six species of wood-decaying *Fomes* collected in Japan, including *F. fastuosus*, causing pocket rot of *Melia azedarach* var. *japonica*, and *F. hamatus* (Corner) Imazeki n. comb. (syn. *F. senex* var. *hamatus*) causing a white rot of *Castanea crenata* and *Castanopsis cuspidata*.

HIRATSUKA (N.). **Miscellaneous notes on the East Asiatic Uredinales with special reference to the Japanese species.**—*J. Jap. Bot.*, xvi, 10, pp. 613–617, 1940.

This critically annotated list of 14 Japanese rusts [*R.A.M.*, xix, pp. 240, 729] includes, besides three new species, a new host, *Rhododendron parvifolium*, for *Chrysomyxa rhododendri* [ibid., xiv, p. 174].

DE SOUSA DA CAMARA (E.), DE OLIVEIRA (A. L. B.), & DA LUZ (C. G.). **Uredales aliquot Lusitaniae I.** [Some rusts of Portugal I.]—*Agron. lusit.*, i, 4, pp. 410–434, 1939. [Received January, 1941.]

A critically annotated list is given of 40 rusts collected in Portugal from 1937 to 1939, 11 of which are enumerated in the present instalment as new records for the country. Mention may be made of the following: *Uromyces betae* on beet, *U. ciceris-arietini* on *Cicer arietinum* [*R.A.M.*, xviii, p. 549], *U. renovatus* on lupins (*Lupinus albus*. *L. angustifolius*, *L. cosentini*, and *L. digitatus*), *U. graminis* on the petioles and inflorescences of *Foeniculum vulgare* [ibid., xix, p. 566] (the aecidial stage obtained by inoculation), *U. fabae* on lentils [ibid., xviii, p. 204], *U. phaseoli vignae* [*U. vignae*] on cowpea [ibid., xviii, p. 91], *U. striatus* [ibid., xviii, pp. 141, 397] on *Medicago hispida*, *U. terebinthi* on pistachio nut [ibid., xiv, p. 742], *Kuehneola* [*Cerotelium*] *fici* on figs [see above, p. 124], *Gymnosporangium amelanchieris* on *Amelanchier vulgaris* [ibid., xv, p. 609], *G. juniperi* on *Pyrus aucuparia* [ibid., xvii, p. 535], *G. sabinae* on pear and *Juniperus phoenicea*, and *Puccinia antirrhini* (first record for Portugal) on *Antirrhinum majus*, *A. graniticum*, *A. linkianum*, and *A. meonanthum*.

DE HAAN (I.). **Kaligebrek in de Theecultur.** [Potash deficiency in Tea cultivation.]—*Bergcultures*, xiv, 41, pp. 1292–1295, 3 figs., 1 graph, 1940.

The writer's observations in West Java (in collaboration with Schoorel) on the physiological importance of potash in the metabolism of the tea

plant, as determined by the pathological symptoms developing in the presence of insufficient quantities of the element in the soil, as well as by ash analyses, have already been summarized from another source [*R.A.M.*, xx, p. 83].

GADD (C. H.). **Ring-barking of trees, and root diseases.**—*Tea Quart.*, xiii, 3, pp. 117–123, 1940.

Discussing the ring-barking of trees in relation to root diseases of tea in Ceylon [cf. *R.A.M.*, xix, pp. 369, 678], the author states that locally the disease common in jungle clearings is *Poria hypolateritia*, but as in the case of *Armillaria mellea* in Nyasaland [ibid., xix, p. 311], preliminary examination of the standing jungle gives little indication of where the disease may occur when tea is planted. There is virtually no evidence in Ceylon that new centres of infection by *P. hypolateritia* are started by spores. The indications are that diseased areas of tea planted in jungle clearings originate from the jungle roots. In areas planted on grass land the problem of jungle roots never arises, but when shade trees are felled root disease may originate at the stump and pass to the tea, the roots of which are in contact with the stump roots.

In a case reported by the author [ibid., xvi, p. 635], some 6,000 *Grevillea* trees grown as shade for tea were felled, and about two years later 30 per cent. of the stumps gave rise to brown root disease (*Fomes noxius*), over 3,000 tea bushes requiring to be eradicated; it is possible that this outbreak was due to underground infection of the stump roots, and not to spore infection, though in this case *F. noxius* must have been living freely in the soil, or it was already established on the roots of *Grevillea* or tea. Records from an up-country estate show that 1,752 *Grevillea* trees were ring-barked in 1930, and cut down at a height of 3 to 4 feet in 1939, but that no case of root disease has so far occurred in the tea associated with these roots. It is therefore apparent that killing trees by ring-barking before felling does not materially increase the danger of subsequent root diseases, but more probably reduces it. The method is worth testing whenever shade trees have to be removed, though it is recommended that the practice of eliminating exposed wood surfaces be maintained also.

BEST (R. J.). **The action of electrolytes on solutions of Tobacco mosaic virus nucleoprotein (Marmor tabaci var. vulgare Holmes).**—*Aust. J. exp. Biol. med. Sci.*, xviii, 3, pp. 307–312, 1 fig., 1940.

Full details are given of chemical studies on the effect of electrolytes on the precipitation of the tobacco mosaic virus protein. With the majority of salts the virus precipitated at and near the critical concentration was in the form of fibres or acicular paracrystals, the length and thickness of which varied with the different salts. A marked influence on precipitating power was found to be exerted by the anion, a lyotropic or Hofmeister series being evident with the following order of efficiency (on a molar basis): nitrate < thiocyanate < iodide < bromide < chloride, succinate, acetate < phthalate < phosphate < oxalate < tartrate < malate < sulphate < citrate. Salicylates act anomalously and denature the protein [*R.A.M.*, xix, p. 496].

LEA (D. E.) & SMITH (K. M.). **The inactivation of plant viruses by radiation.**—*Parasitology*, xxxii, 4, pp. 405–416, 6 graphs, 1940.

A full description is given of experiments at the Plant Virus Research Station and the Strangeways Research Laboratory, Cambridge, on the inactivation by X-rays (nearly monochromatic, wave-length 1·5 Å.) [*R.A.M.*, xix, p. 437] and ultra-violet light (Vitreosil 'Home-Sun' lamp, operating at 50° C. and containing neon, and mercury vapour at low pressure, 2537 Å.) of crude clarified sap, collodion filtrates, precipitates, and purified preparations of the tobacco mosaic (*Nicotiana* virus 1), tobacco necrosis (*N.* virus 11), and tomato bushy stunt (*Lycopersicum* virus 4) viruses, the effects of the treatment being determined by the half-leaf inoculation method, using French bean (*Phaseolus vulgaris*) as a test plant for tobacco necrosis and *Nicotiana glutinosa* for tobacco mosaic and tomato bushy stunt. The curves obtained by plotting against the dose of radiation the number of lesions resulting from inoculation of a test plant were found to be exponential, the degree of inactivation being proportional to the intensity of irradiation. The inactivation curves obtained with preparations of a given virus in different states of aggregation do not appear to differ systematically. The mechanism of aggregation in virus suspensions is discussed in the light of these results.

THORNBERRY (H. H.) & ANDERSON (H. W.). **Pink-root disease of Onions on Tomatoes.**—*Plant Dis. Reptr*, xxiv, 19, pp. 383–384, 1940. [Mimeographed.]

During 1940 tomatoes near Chicago developed a pink-root disease apparently due to *Phoma terrestris* [*R.A.M.*, xix, pp. 4, 328]. The small roots showed the discoloration, and were largely disintegrated; the large roots were not infected, but the lateral roots were discoloured. The chief symptom above ground was stunting. The condition was present only in soil recently planted to onions.

According to unpublished information supplied by E. J. Melhus from a thesis by W. A. Kreutzer (Host-parasite relationships in the pink-root disease of Onions. Thesis, Ames, Iowa, 1939) [cf. ibid., xix, p. 4], the host range of *P. terrestris* comprises barley, cane [? sweet sorghum], cantaloupe, carrot, cauliflower, maize, cucumber, eggplant, muskmelon, oats, pea, pepper [*Capsicum* (?) *annuum*], soybean, spinach, squash, tomato, and wheat.

DUNN (S.). **Rust causing injury to Ash trees in New Hampshire.**—*Plant Dis. Reptr*, xxiv, 19, p. 394, 1940. [Mimeographed.]

During the past two seasons ash trees in south-eastern New Hampshire, especially round Portsmouth, have been severely affected by rust (*Puccinia peridermiospora*) [*R.A.M.*, ii, p. 179] which in some instances has caused almost complete defoliation. The stage on the alternate host was found in *Spartina patens*.

GRANT (T. J.) & CHILDS (T. W.). **Nectria canker of north-eastern hardwoods in relation to stand improvement.**—*J. For.*, xxxviii, 10, pp. 797–802, 1940.

Data on the incidence of *Nectria* cankers on north-eastern hard-

woods [*R.A.M.*, xviii, pp. 558, 827] were obtained from 75 widely separated $\frac{1}{10}$ acre-plots in New England, New Hampshire, and Vermont. Roughly one-third of the plots were canker-free, one-third showed 1 to 10 per cent. infection, and the remainder 11 to 80 per cent. Beech was free of cankers on some 80 per cent. of the plots on which it was represented and only slightly attacked on the rest; discrimination against this hardwood (not one of the 'useful' group) is therefore unnecessary from the standpoint of *Nectria* control. The so-called 'weed' hardwoods (aspen [*Populus tremula*], pin cherry [*Prunus pennsylvanica*], and mountain and striped maples [*Acer spicatum* and *A. pennsylvanicum*]) were no more frequently or severely cankered than the 'useful' sugar and red maples [*A. saccharum* and *A. rubrum*] and paper and yellow birches [*Betula papyrifera* and *B. lutea*], but their occurrence was significantly correlated ($0{\cdot}249 \pm 0{\cdot}109$) with infection of the latter. The disease was more prevalent in pure than in mixed stands, and at high than at lower altitudes, the correlation in the latter case being $0{\cdot}326 \pm 0{\cdot}104$; injury by wind and sleet on the elevated sites is probably an important factor in the heavier incidence of canker in such positions. Analyses of the data obtained in surveys of strips 13·2 ft. wide in four moderately to severely infected stands revealed a general tendency to greater susceptibility among yellow birches than the other 'useful' trees under observation. The differences between individuals in this respect, however, were so striking as to suggest inherent constitutional variations in reaction to the pathogen. Correlations between cankering and diameter at breast height ranged from positive (highly significant) to slightly negative.

SMUCKER (S. J.). **Apparent recovery of American Elms inoculated with Ceratostomella ulmi.**—*Phytopathology*, xxx, 12, pp. 1052-1054, 1940.

Out of 115 small American elms (*Ulmus americana*) trees inoculated in 1936 with *Ceratostomella ulmi* at the Division of Forest Pathology, New Jersey, and contracting severe infection as a result, only three manifested any external symptoms in 1937 and one in 1938. In the remainder the number yielding viable cultures of the organism declined from 100 per cent. in January, 1937, to 73·2 in April, 1940, indicating that the apparent recovery of the infected trees was due neither to lack of pathogenicity of the fungus nor the acquisition of immunity by the host, but merely to the gradual dying-out of the inoculum [cf. *R.A.M.*, xix, p. 442].

**Present status of the Dutch Elm disease.**—*Plant Dis. Reptr*, xxiv, 17, pp. 349–350, 1 map (on p. 348), 1940. [Mimeographed.]

Between 9th and 23rd September 1939 Dutch elm disease (*Ceratostomella ulmi*) [*R.A.M.*, xix, pp. 124, 680] was found for the first time in south-eastern Chenango County, adjoining Broome County, New York, while additional infections were observed in Broome and Columbia Counties, New York, and Monroe County, Pennsylvania. In 1940 the infection area round New York harbour was extended into two further counties. In Connecticut the disease was found in four more towns in Litchfield County, and for the first time in two towns

in New Haven County and one in Fairfield County. A new outlying area of infection was noted in Luzerne County, Pennsylvania. Single trees were confirmed as infected in Delaware County, New York, and Susquehanna County, Pennsylvania, while another tree in Wayne County, Pennsylvania, may also prove to represent an extension of the same area.

KELSHEIMER (E. G.) & MAY (C.). **Prevalence of Elm dieback caused by Dothiorella ulmi.**—*Plant Dis. Reptr*, xxiv, 18, p. 370, 1940. [Mimeographed.]

A table is given [on p. 369] showing the relative prevalence of dieback (*Dothiorella ulmi*) [*R.A.M.*, xviii, p. 557] among the wilt diseases [unspecified] of elms during 1930 to 1938 in those parts of New York, Connecticut, New Jersey, Ohio, Maryland, Pennsylvania, Indiana, and West Virginia, in which scouting for Dutch elm disease [*Ceratostomella ulmi*: see preceding abstracts] has been carried out. The table records the presence of *D. ulmi* in 31 States, the District of Columbia, and Canada.

GRAVES (A. H.). **Breeding work toward the development of a timber type of blight-resistant Chestnut. Report for 1939.**—*Bull. Torrey bot. Cl.*, lxvii, 9, pp. 773–777, 1940.

Lists are given of the chestnut species, varieties, and hybrids grown in co-operative plantations in Connecticut and at the Brooklyn Botanic Garden in connexion with the project of breeding for resistance to blight (*Endothia parasitica*) [*R.A.M.*, xix, p. 569]. Notwithstanding the tendency of seedlings of *Castanea sativa* of European origin to die back in the winter and their susceptibility to the disease, an attempt is being made to incorporate this stock into the American material on account of its exceptionally vigorous habit of growth. Tests for resistance by inoculation (as described in the *Rep. nrth. Nut Gr. Ass., 1938*, p. 97) were not carried out in 1939.

FISHER (R. C.). **Studies of the biology of the death-watch beetle, Xestobium rufovillosum de G. III. Fungal decay in timber in relation to the occurrence and rate of development of the insect.**—*Ann. appl. Biol.*, xxvii, 4, pp. 545–557, 1940.

The results of experiments conducted at Princes Risborough under different conditions of temperature and humidity have led to the conclusion that although temperature and humidity have an important effect on the rate of development of the death-watch beetle, *Xestobium rufovillosum*, the factor finally determining the suitability of timber for infestation is the presence of fungal decay. It was found that oak and willow [*Salix*] wood and structural timber decayed by wood-destroying fungi (*Polyporus sulphureus* and *Fistulina hepatica* [*R.A.M.*, xix, p. 245] on oak, *P. fumosus*, *Polystictus versicolor*, *Trametes suaveolens*, *Coniophora cerebella* [*C. puteana*], and *Xylaria hypoxylon* on willow, and *Phellinus cryptarum* [see next abstract], *C. puteana*, *Merulius lacrymans*, *Polyporus sulphureus*, *Poria vaillantii*, *P. medulla-panis*, *F. hepatica*, and *Paecilomyces varioti* on timber) were more suitable for the larval development of the insect than sound wood. In decayed wood

and timber the progress of its attack was much more rapid, and there was some indication that an increased severity of fungal decay tended to shorten the duration of its life-cycle.

CAMPBELL (W. G.) & BRYANT (S. A.). **A chemical study of the bearing of decay by Phellinus cryptarum Karst. and other fungi on the destruction of wood by the death-watch beetle (Xestobium rufo-villosum de G.)**—*Bio-chem. J.*, xxxiv, 10–11, pp. 1404–1414, 1940.

The effect of decay by *Phellinus cryptarum* Karst. on the chemical composition of oak sapwood [*R.A.M.*, xvi, p. 4] was studied in detail at the Forest Products Research Laboratory, Princes Risborough, and the results are here fully tabulated and discussed. The fungus was shown to cause a white rot of the class involving the simultaneous decomposition of all the major components of the wood. The maximum loss in weight from decay was estimated at 75 per cent., and the fact that at this stage the wood still contained lignin is considered to furnish conclusive proof that this constituent is not the sole source of fungal nourishment in the white rot group.

The data obtained from analyses of the frass of the death-watch beetle (*Xestobium rufovillosum*) [see preceding abstract] in 20 samples of infested oak yielded no evidence that any particular fungus predisposes the wood to invasion by the insect, the abundance of which in decayed material (mostly of the brown rot type) is further regarded as independent of the relative plenty or availability of any special food component resultant on fungal activity. It was found that, as the extent of fungal rotting of the substratum increases, the numerical value of the abstraction coefficient (defined as 'the wood digested by a group of insects when expressed as a percentage by weight of the wood disintegrated during boring by the same group') diminishes over the range of loss of 26 to 73 per cent. of the dry weight of original wood due to decay. Hence it is concluded that the primary function of the fungus in the biological succession does not lie in the chemical modification of the components of the wood in such a way as to facilitate their digestion by *X. rufovillosum*. On the other hand, the relatively better development of the beetles in rotted than in more or less sound wood is attributed to the depreciation in the mechanical strength of the former by the fungus, and its consequent inability to oppose effective resistance to boring by the larvae, the rate of which increases *pari passu* with the advance of fungal disintegration.

CHAPMAN (A. D.) & SCHEFFER (T. C.). **Effect of blue stain on specific gravity and strength of Southern Pine.**—*J. agric. Res.*, lxi, 2, pp. 125-133, 1940.

In tests conducted under controlled conditions with wood blocks, $\frac{3}{4}$ by $\frac{3}{4}$ by 10 in., of southern pine [*Pinus* spp.] inoculated with pure cultures of four species of the blue-staining fungi (*Ceratostomella pilifera*, *Graphium rigidum*, *C. pini*, and *C. ips*) the strength properties of the stained wood [*R.A.M.*, xix, p. 180] appeared generally lowered, but the reduction was significant only for toughness and work to maximum load, amounting to from 9 to 75 per cent. for the former and from 14 to 41 per cent. for the latter property. In only 6 tests out of 20 was the

specific gravity of the stained wood significantly lower than that of the controls. The four fungi did not attack the wood with equal severity and the same fungus did not have the greatest effect on all properties. There was some indication that the abundance of direct cell wall penetration by the fungi was broadly related to a reduction in toughness. The intensity of discoloration caused by these fungi may be indicative of the severity of attack for individual species but not for all species. The predominance of a particular staining fungus in a certain kind of wood does not necessarily indicate a greater harmful effect on the strength properties of this wood than that of a less prominent fungus. Staining tended to have a greater effect on heated wood than on unheated [ibid., xiii, p. 284]. Accumulated data indicate that blue stain, at least in unheated pine wood, reduces strength properties comparatively little, but the conditions favouring staining also favour decay fungi and hence it is often desirable to examine heavily stained material for signs of decay.

FINDLAY (W. P. K.). **Studies in the physiology of wood-destroying fungi. III. Progress of decay under natural and under controlled conditions.**—*Ann. Bot., Lond.*, N.S., iv, 16, pp. 701-712, 1 fig., 4 graphs, 1940.

In further studies on the physiology of wood-destroying fungi [cf. *R.A.M.*, xiii, pp. 485, 609] beech (*Fagus sylvatica*) samples were oven-dried, weighed, autoclaved, and placed on cultures of *Polystictus versicolor*, a white rot fungus, growing under moist conditions at 22° C. on 2 per cent. malt agar in special Kolle flasks. After 1, 2, 3, 6, 12, 18, and 24 months, the average loss of weight amounted to 7·4, 19·7, 26·2, 49·3, 75·7, 85·2, and 94·5 per cent., respectively, the maximum loss in any one sample being 99·4 per cent. Rate of loss of weight, after slight initial acceleration, remained more or less constant until about 75 per cent. of the original weight was lost, after which decomposition became retarded. This experiment shows that beech can be completely destroyed by a single species of fungus causing an active white rot. On the other hand brown-rotting fungi, e.g., *Coniophora cerebella* [*C. puteana*], *Merulius lacrymans*, or *Lenzites trabea*, which leave the lignin almost unaffected, do not remove more than about 70 per cent. of the wood substance and in an experiment with *Poria vaillantii*, another brown rot fungus, the average loss of weight of Scots pine [*Pinus sylvestris*] sapwood blocks after 24 months was only 55·5 per cent. The moisture content of the beech samples remained at about 50 per cent. of the over-dry weight for six months in the first experiment, and then began to rise, the curve representing the rise running roughly parallel with that for the loss in weight. It is evident that a much higher moisture content is required for fungal growth in badly decayed than in sound wood.

Investigation was next made of the effect of partial decay by a white rot fungus upon the liability of the wood to decay by a brown rot fungus, and vice versa. When sound beech blocks were exposed to *Polystictus versicolor* for four months, loss in weight averaged 40·9 per cent. but when the blocks were first decayed by the brown rotting *C. puteana* (26·8 per cent. loss) and then sterilized, loss from *P. versicolor*

averaged 50·6 per cent. *C. puteana* on sound wood caused 26·8 per cent. loss, and on wood first decayed by *P. versicolor* (40·9 per cent. loss) and then sterilized, 35·5 per cent. loss. In another experiment loss in dry weight after 8 months was 50·6 per cent. for *P. versicolor* alone, 30·9 per cent. for *C. puteana* alone (this figure being too low, as the samples had become too dry); 61·7 per cent. for wood exposed to *P. versicolor* for 4 months, sterilized, and exposed to *C. puteana*; 62·7 per cent. for treatment like the preceding but the *P. versicolor* not killed; 63·3 per cent. for wood exposed to *C. puteana* for 4 months, sterilized, and then exposed to *P. versicolor*; and 39·8 per cent. for treatment as the preceding but the *C. puteana* not killed. This result shows that when the first fungus was killed before inoculation with the second, total loss was about the same whichever acted first, but loss was smaller when wood containing living *C. puteana* was exposed to *P. versicolor* than when *C. puteana* was placed on wood with living *P. versicolor*.

Blocks of Scots pine sapwood rotted to various degrees by *Poria vaillantii* were then arranged in groups according to loss in weight and exposed for three months to attack by *Polystictus versicolor*. In the controls, not exposed to *Poria vaillantii*, loss due to *Polystictus versicolor* averaged 27 per cent. Where loss by *Poria vaillantii* amounted to not over 5 per cent., that by *Polystictus versicolor* was 14·7 per cent., this figure falling steadily with each increase in loss from *Poria vaillantii*, until it was only 3·6 per cent. for samples with 35 to 45 per cent. loss from *P. vaillantii*. It is evident that the removal by a brown rot of the cellulose in a coniferous wood renders the wood less suitable for subsequent attack by a white rot.

The evidence available suggests that it is true only to a limited extent to speak of a successional flora in the process of decomposition of a log. The first organisms to appear feed on the readily available food materials; next, true wood-rotting fungi develop, and if a white rot is induced, complete disintegration may be produced by a single species acting alone. Preliminary rotting by a white rot renders wood more susceptible to a brown rot. Wood slightly decayed by a brown rot is rotted by a white rot at least as rapidly as sound wood, but advanced brown rot is not often succeeded by a white rot.

NAKAZIMA (Y.) & SUZUKI (S.). **The rapid deterioration of copper-sulphate-impregnated poles and other related problems.**—Abs. in *Quart. J. Inst. elect. Commun. Engrs Japan, 1940,* 20, pp. 267–268, 1940.

The rapid deterioration of copper sulphate-impregnated poles in a district of Sendai, Japan, was found to be due to the properties of the local soil, the alternations of which between moisture and dryness caused excessive dissolution of the chemical. Poles impregnated with creosote by the Bessel process are the best suited to this type of ground. In the present method of preservation, uniformity of cross-sectional penetration is more important than the amount of copper sulphate per cu. in. absorbed, and there is reason to believe that adequate protection could be secured by the dilution of the treating solu-

tion to a density involving the deposit of 3 to 4 kg. copper sulphate, thoroughly and evenly distributed over the pole.

COOK (H. T.) & NUGENT (T. J.). **Truck crop investigations. The control of truck crop diseases in Tidewater, Virginia.**—*Bull. Va Truck Exp. Sta.* 104, pp. 1663–1717, 1 diag., 1941.

Directions are given in popular terms for the control, by cultural measures (including varietal selection) and chemical treatments, of a number of well-known diseases of asparagus, snap beans [*Phaseolus vulgaris*], Lima beans [*P. lunatus*], beets, celery, crucifers, cucurbits, eggplants, lettuce, onions, peas, peppers [*Capsicum* spp.], potatoes, spinach, sweet corn (maize), sweet potatoes, strawberries, and tomatoes. The bulletin also contains information on the etiology and control of vegetable diseases, as well as on the preparation and application of fungicides.

**Annual Report of the (Gambia) Department of Agriculture, for the year ending 31st May, 1940.**—8 pp., 1940.

On p. 4 of this report it is stated that the early planting of groundnuts and close spacing of the seed ensured comparative freedom from rosette [*R.A.M.*, xii, p. 5], no serious outbreaks of which occurred during the period under review.

**O Cacaueiro e a "vassoura de bruxa".** [Cacao and 'witches broom'.]—*Biológico*, vi, 10, p. 302, 1940.

In accordance with the provisions of article 29 of the (Brazilian) plant protection regulations of 12th April 1934, the territory of Acre and the States of Amazon and Pará are declared to be infested by witches' broom of cacao (*Marasmius perniciosus*) [*R.A.M.*, xvii, p. 801], and commerce in fresh seeds, fruits, and plants of cacao and related species of the Sterculiaceae between these regions and other States of the Brazilian Union or foreign countries is prohibited by an Order of 12th August 1940. Similar restrictions apply to soil, whether adhering to the above-mentioned plants or not, within the quarantine zone, all material destined for export from which must be grown in special fields under the supervision of the plant protection authorities and accompanied by certificates of freedom from disease.

**Bundaberg-Childers Cane quarantine area. Amendment of Proclamation No. 5.**—*Aust. Sug. J.*, xxxii, 8, p. 420, 1940.

Proclamation No. 5 of the Sugar Experiment Stations Acts, 1900 to 1938, originally issued in March 1939, and amended in the following July, by a new amendment dated 19th October 1940, prohibits (1) the removal (except for milling) of any sugar-cane from any farm in the Bundaberg-Childers area of Queensland on which Fiji disease [*R.A.M.*, xix, p. 116] or downy mildew [*Sclerospora sacchari*] has been found during the preceding three years; (2) the growing on any such farm of the varieties P.O.J. 213, 234, 2725, 2875, or 2878 beyond the third calendar year after that of planting, without a written permit from the Director; and the acceptance by mills for milling purposes of canes of the above-mentioned varieties, after the lapse of the prescribed period, unless the grower is in possession of a permit for their cultivation and removal.

IMPERIAL MYCOLOGICAL INSTITUTE

# REVIEW
OF
# APPLIED MYCOLOGY

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Simon (M.). **The yellows disease of Sugar Beets.**—*Publ. Inst. belge Amélior. Better.*, viii, 1, pp. 20–22, 1940. [Abs. in *Facts ab. Sug.*, xxxv, 12, p. 43, 1940.]

The virus of sugar beet yellows, described as one of the principal diseases of the crop in western Europe [*R.A.M.*, xix, p. 187], is stated to be spread by *Aphis fabae*, which acquires the virus by sucking one of the many plants harbouring it, e.g., spinach. In the beet-growing regions of Belgium, however, the chief sources of infection appear to be silos and feed lots, where the crowns of diseased plants of the preceding crop put forth sprouts on which the aphid feeds before flying out to the fields. The losses from yellows may be reduced by eliminating these reservoirs of the virus, the early planting of non-bolting varieties, and the maintenance of a plentiful supply of soil moisture by irrigation.

Walker (J. C.), Delwiche (E. J.), & Smith (P. G.). **Pea seed treatment with chemical dusts.**—*J. agric. Res.*, lxi, 2, pp. 143–147, 1940.

The results of experiments conducted in Wisconsin from 1936 to 1939, inclusive, showed that the beneficial effects of treating pea seeds with either red copper oxide or 2 per cent. ceresan dusts will vary with the season and locality [cf. *R.A.M.*, xix, p. 257]. Neither treatment had any effect on the starch-seeded Alaska variety at any time during the four-year experimental period. In a Colby silt loam soil of relatively high water-holding capacity at Marshfield, significant improvement in stand was achieved in only one out of four years (that of heaviest precipitation) and only with red copper oxide. In tests in 1938–9 with silt loam soil from Sturgeon Bay and Madison, consistently greater benefits from seed treatment were observed in the moister soil from Sturgeon Bay. The early and late sowings in this locality in 1938, however, both showed improved stands after treatment, although the rainfall during the early sowing was 2·34 in. as compared with 0·44 in. during the late.

It is concluded from these results that the conditions favouring [unspecified] cotyledon decay during germination occur periodically, but not necessarily consistently, under average Wisconsin conditions. They do not seem to affect the starchy-cotyledoned forms, but may

reduce the stands of the sugary-seeded varieties. Of the two materials tested, red copper oxide proved to have a beneficial protective influence on all varieties of the latter group, while ceresan was less effective.

SMIETON (MARGARET J.) & BROWN (W.). **Botrytis disease of Lettuce, its relation to damping-off and mildew, and its control by pentachloronitrobenzene dust.**—*Ann. appl. Biol.*, xxvii, 4, pp. 489–501, 1 pl., 1 graph, 1940.

Extending the experiments on the control of the *Botrytis* [*cinerea*] disease of lettuce started by W. Brown in 1934–5 [*R.A.M.*, xv, p. 196] for four more years, the authors tested the effect of treating spring lettuces, sown in cold frames in the autumn and transplanted into the open in early spring, with pentachloronitrobenzene (referred to as Pcnb) in the form of a dust containing 80 per cent. of talc or slaked lime as filler. [In a footnote it is stated that this dust, referred to in the earlier paper as brassisan, is now termed folosan [ibid., xix, p. 130], the former name having been transferred to another preparation containing trichlorodinitrobenzene.] The dust was worked into the top soil of frames to a depth of about 2 in. at the rate of 1 oz. per sq. yd. or sprinkled on the surface just after sowing; in addition the seedlings were dusted several times before transplanting. The treatment consistently gave large increases in stand of seedlings (902 to 2,550 plants per frame as against 106 to 1,558 in the untreated series) and in the percentage of subsequent survivals in the field (58 to 86 as against 15 to 55 in the controls). The date of maturity was, on the other hand, delayed by up to seven days in the treated plants.

Apart from *B. cinerea* a number of other fungi are responsible for losses of plants in the frame and later in the field. Of these, damping-off caused by *Rhizoctonia* [*Corticium*] *solani* was effectively controlled by adding Pcnb to the covering soil at the rate of 24 to 60 oz. per cu. yd. This reduced the percentage of damped-off plants to from 1·7 to 5 as compared with from 35 to 93 in the untreated control and a further experiment showed the dose could be reduced to 12 oz., but it was valueless for the control of pre- and post-emergence damping-off caused by several [unspecified] species of *Pythium*. Mildew (*Bremia lactucae*) may in some seasons cause serious damage, and, as well as damping-off, is potentially important in providing dead leaf tissue on which *Botrytis cinerea* is liable to develop under suitable conditions.

Experience showed that the dust may cause a visible check to growth, which is greater the smaller the plants, the lower the temperature, and the heavier the dose applied. No applications should, therefore, be made while the seedlings are very small, except for a light dusting should damping-off or mildew be observed. From the end of December onwards moderate applications can be given at three- to four-week intervals, and a thorough final one just before the plants are pulled for transplantation. Replicated experiments showed that three applications at the rate of $\frac{1}{4}$ oz. per sq. yd. give adequate disease control for the four to five months during which the seedlings are in the frame. With regard to the control of *Bremia lactucae*, the fungicidal efficiency of Pcnb was materially reduced when talc was replaced by lime as a filler. After the severe frost of 1940, dusted plants showed more injury than undusted,

this effect being, however, less noticeable in other seasons. During severe frost dusting should, therefore, be suspended.

PRYOR (D. E.). **The effect of some mineral nutrients on the development of clubroot of crucifers.**—*J. agric. Res.*, lxi, 2, pp. 149–160, 3 figs., 1 diag., 1940.

The effect of sulphur, nitrogen, and potassium nutrition on the development of club root (*Plasmodiophora brassicae*) [*R.A.M.*, xix, p. 449] in susceptible, resistant, and immune strains of crucifers was studied under controlled greenhouse conditions in Wisconsin. Infection was secured in sand cultures by inoculating the potted plants at the first true leaf stage and a fortnight later with the spore suspension applied to the surface of the sand with a pipette. The percentage of diseased plants was comparable to that obtained in infested, acid soil. The inoculated plants developed either the usual normal type of relatively smooth clubs or small galls, 1 or 2 mm. in diameter, appearing usually, but not always, at the base of a branch root. The results of these tests indicate that varying nutrition has a most pronounced effect on disease development in susceptible plants, but does not influence resistance in immune varieties such as the Purple Top Milan turnip, which developed no signs of club root under any conditions of nutrition brought about in these experiments. The percentage of susceptible plants developing clubs was in general increased slightly over that of plants receiving the complete nutrient solution by an abundance of potassium, more by an abundance of nitrogen, and most by a deficiency of sulphur or nitrogen, the latter effect being greater in resistant plants. The percentage was decreased markedly by potassium deficiency. In the case of resistant plants club development was increased somewhat by high supplies of nitrogen, it was greatest when sulphur or nitrogen were deficient, and was definitely decreased by lack of potassium, while the results obtained with other nutrition series were not conclusive. Since nitrogen starvation, which did not appreciably lower the mustard oil content of crucifers, increased club root infection to about the same degree as sulphur starvation, which did greatly lower it, it is concluded that sulphur oils are not essential to the host in preventing or retarding club root development.

METCALFE (G.). **Bacterium rhaponticum (Millard) Dowson, a cause of crown-rot disease of Rhubarb.**—*Ann. appl. Biol.*, xxvii, 4, pp. 502–508, 1940.

In this paper a detailed account is given of a crown rot disease of Victoria rhubarb stated to be prevalent in cottage gardens in central Yorkshire and believed to be identical with that described by Millard [*R.A.M.*, iii, p. 628]. Isolations from diseased rhizome and rotting bud tissue yielded various bacteria, fungi, and eelworms, but the only pathogenic organism among them corresponded with Millard's *Bacterium rhaponticum*, although the measurements of single cells were about 1·2 to 1·5 by 0·5 to 0·8 $\mu$ and thus smaller than those given by Millard. The author gives a revised description of the causal organism as follows: the bacterium possesses three to seven peritrichous flagella, which stain by Morton's method; it is not readily motile, although some good motile

preparations were obtained; it forms acids but no gas from arabinose, xylose, dextrose, levulose, galactose, mannose, sucrose, maltose, lactose, mannitol, glycerol, and salicin, and does not utilize starch; it forms acid on litmus milk, reduces nitrates, produces no indol in broth, no hydrogen sulphide, and does not liquefy gelatine. It grew at all temperatures from 0° to 37° C. and withstood drying for at least eight days and night temperatures of —5°. Some strains of the organism secreted a pink pigment and in others chromogenesis could be induced by subculturing. Passage through Cohn's solution suppressed the induced but not the natural chromogenesis. The pathogenicity of the organism was proved in inoculation experiments, a fairly saturated atmosphere being necessary for successful infection.

The eelworm *Anguillulina dipsaci* held by Johnson to be the primary cause of the disease (*Ann. appl. Biol.*, xxvi, p. 739, 1939), was found by the author to be present in all the naturally infected material examined, but in all the inoculation experiments typical rot was produced in the absence of *A. dipsaci*. It is, however, thought probable that *A. dipsaci* acts as an agent of infection by introducing the pathogen through the wounds it makes. In comparative studies it was shown that *Bact.* [*Erwinia*] *aroideae*, which resembles *Bact. rhaponticum* in its biochemical characters, differs from it in turning litmus milk red, liquefying gelatine, and being non-chromogenic. *Bact. rhaponticum* was shown to differ from the three 'soft rot' bacteria *E. aroideae*, *Bact. carotovorum* [*E. carotovora*], and *Bact. phytophthorum* [*E. phytophthora*] in its pathogenic faculties, and cannot be placed in the same group with them.

Thomas (K. M.). **Detailed administration Report of the Government Mycologist, Madras, for the year 1939–40.**—18 pp., 1940.

The following information is presented in this report [cf. *R.A.M.*, xix, p. 258]. Of the 42 strains and selections of rice tested for their reaction to blast (*Piricularia oryzae*) at the Coimbatore Central Farm, Co. 4 proved to be the most resistant, followed by 11348, Co. 11, and 10998. In experiments to determine the influence of the planting date on infection, the maximum incidence of disease occurred in the October-sown plots and the minimum in those of November.

*Helminthosporium oryzae* [*Ophiobolus miyabeanus*] does not sporulate well in most standard media, but was found to do so in a maize meal-sand mixture and in potato dextrose plus tannic acid. Sporulation was further shown to be more profuse in Petri dish than in tube cultures, a thin layer of potato dextrose agar giving better results than a thick one. Cross-inoculation experiments with *O. miyabeanus* showed wheat and tenai [*Setaria italica*] seedlings to be equally susceptible with rice, but ragi [*Eleusine coracana*] and maize contracted little infection, and cumbu [*Pennisetum typhoides*] and sorghum none (except when wounded). The fungus further attacked the leaves and earheads of rice, *S. italica*, wheat, and barley, whereas oats, *E. coracana*, and maize developed only slight foliar infection. Both seed and soil were found to serve as sources of infection by *O. miyabeanus*, the incidence of disease contracted from either separately ranging from 14 to 20 per cent. and that derived from both simultaneously from 25 to 33. The

thermal death point of the pathogen was found to be 51° C. (10 minutes' exposure).

In an experiment in which 12 varieties of *E. coracana* were sown every month from January to December, the incidence of blast (*Piricularia* sp.) in the resultant crops was heavy in the June, July, and August sowings (39 to 81, 33 to 88, and 69 to 98 per cent., respectively), light in those of May and September, and nil in those of the remaining months. In cross-inoculation tests with strains of *Piricularia* from *E. coracana*, *S. italica*, and rice, those from *E. coracana* and *S. italica* infected their own hosts, two lines of wheat, oats, barley, maize, and *Dactylotenium aegyptiacum* [*E. aegyptiaca*], but not rice, whereas *P. oryzae* from rice attacked all the plants except *E. coracana*.

Comparative cultural studies on the agent of false smut of rice (*Ustilaginoidea virens*) showed that the best growth was made on Quaker oats.

In inoculation experiments with *Colletotrichum falcatum* on sugar-cane setts the maximum spread of infection within the sett occurred at between 30° and 34° C. The spores were killed by five minutes' exposure to a temperature of 51°, which was withstood, however, by the appressoria.

The Co. 205 and 434 sugar-cane varieties have maintained their resistance to mosaic in trials extending over periods of seven and four years, respectively, while Uba (S.H. 38), Uba (S.H. 281), Co. 411, and Co. 422 have also remained free from infection for two, two, three, and two years, respectively.

*C. indicum* was found to penetrate cotton cotyledons both through the stomata and directly through the epidermis, the latter channel also serving for the invasion of the collar region. Penetration is effected some 18 hours after inoculation. Within a week of emergence from infested soil, seedlings from surface-sterilized H–1 cotton seed were all killed, and when the pots were re-sown a month later, 66 per cent. of the seedlings died. The optimum temperature for infection by *C. indicum* was shown to range from 20° to 30°. Only 1 per cent. of the delinted cotton seeds soaked in a spore suspension of *C. indicum* germinated, compared with 37 per cent. of the controls. Ceresan gave good control of seed infection in trays and pots without impairing germination, but failed to eliminate the fungus in plots when rain fell heavily at the time of sowing. The maximum incidence of infection by *C. indicum* was registered in soils with a 30 to 50 per cent. moisture content. The filtrates from two-day-old liquid cultures of the pathogen induced wilting of seedlings in 24 hours, the toxic effects increasing with the age of the cultures and culminating at four weeks in marginal desiccation and wilting in 12 hours. The toxin is not thermostable.

In cultural studies on species of *Phytophthora*, oospores of *P. parasitica* were formed on maize meal agar at 20°; *P. meadii* [ibid., xvi, p. 232] only formed these organs on pairing with *P. arecae*, and in *P. arecae* they only developed on pairing with strains of *Phytophthora* from citrus and Palmyra palm [*Borassus flabellifer*].

One monsoon (late July) treatment with 1 per cent. Bordeaux mixture proved very effective for the control of citrus leaf and fruit fall due to *Phytophthora* sp., but a considerable increase of yield

resulted from two applications of the same preparation, the first being given towards the end of May.

Seed treatment with ceresan (0·25 per cent., 30 minutes) effectively controlled the ginger rhizome rot due to *Pythium* spp., while the best means of preservation of seed ginger in pits was by 1½ hours' immersion in 0·1 per cent. mercuric chloride.

Little leaf of brinjal [eggplant] was transmitted by grafting to the following additional hosts: *Withamia somnifera*, potato, *Solanum pubescens*, and *S. seaforthianum*, and with the aid of *Eutettix phycitis* to *S. xanthocarpum*, *S. trilobatum*, and *Datura fastuosa*.

PHILLIPS (E. P.). **Control of crop and plant diseases. Annual Report of the Division of Botany and Plant Pathology.**—*Fmg S. Afr.*, xv, 177, pp. 519–520, 1940.

In this report on plant disease work in South Africa in 1940 [*R.A.M.*, xix, p. 195], the author states that seed of tomato strains from the United States bred for resistance to spotted wilt in California, when grown locally, gave rise to plants every variety of which was susceptible to kromnek [ibid., xix, p. 620; xx, p. 85]; the supposedly resistant red currant variety [*Lycopersicum pimpinellifolium*] showed 20 per cent. infection, and the remainder over 60 per cent.

Varietal resistance tests at Nelspruit have demonstrated that the Marvel tomato variety is the most resistant of those tested to *Fusarium* [*bulbigenum* var.] *lycopersici* [loc. cit.]. Preliminary studies indicated that the fungus is favoured by a low $P_H$ value of the soil, and that in the eastern Transvaal the figure ranges from 5·2 to 6·4. Experimental evidence indicated that it may prove economically possible to increase the $P_H$ value of the soil by means of agricultural lime and calcium cyanamide. The deleterious effect of fungal attack appears to decrease markedly with increase in the soil $P_H$.

During the summer, pine species in the Sabie Forest Reserve developed a severe outbreak of disease. *Diplodia pinea* [ibid., xviii, p. 656] was observed in a viable condition on all the affected trees, on fallen needles, on thinnings cut out two years before, and on standing trees which had been dead for four years. The severity of the attack was attributed to injuries caused by a severe hailstorm, succeeded by a period of misty weather. The effects of the disease were visible six weeks after the storm, and after three months considerable patches of trees were dead.

Wheat and barley foot rots due to *Helminthosporium sativum* and associated fungi and take-all due to *Ophiobolus graminis* [ibid., xix, p. 587] are likely to prove a limiting factor in production in grain-growing areas of the Transvaal, unless preventive measures are adopted.

*Puccinia antirrhini* now occurs on *Antirrhinum* [*majus*] in all parts of the Union [ibid., xix, p. 350] and will probably seriously affect the cultivation of this plant.

Tobacco leaf curl was found to occur naturally in petunias, while another form of the disease was associated with hollyhocks.

Between 1st August, 1939, and 31st July, 1940, 513,123 [citrus] trees were inspected in the Barberton, Pretoria, Rustenburg, Brits, and Waterberg areas of the Transvaal, and 1,468 showed the presence of

psorosis [ibid., xix, p. 196]; in the Cradock, Oudtshoorn, and Prince Albert districts of the Cape Province, 19,555 trees were inspected and 36 found affected.

Work at Nelspruit on [citrus] dry root rot [loc. cit.] has shown that the condition may be induced by certain soil treatments.

Between October, 1939, and February, 1940, a detailed survey was made in Cape Province of vineyards in districts affected by bacterial blight [*Erwinia vitivora*: ibid., xix, p. 384; xx, p. 44]. The survey covered a total of 30,881,602 vines and all registered nurseries were visited, comprising 507 in 17 districts. At the annual sales held at Stellenbosch, Paarl, and Worcester only vines from registered nurserymen were allowed to be sold, and steps were taken to see that the regulations governing the transport of vines were observed. The evidence indicates that if proper control of nursery material is maintained, distribution of the disease may be limited and further spread prevented. Only one new occurrence of the disease was recorded.

SIMMONDS (J. H.). **Report of the Plant Pathological Section.**—Ex *Rep. Dep. Agric. Qd, 1939–40*, pp. 10–11, 1940.

This report on plant disease work in Queensland [*R.A.M.*, xix, p. 458] includes the following items of interest. The lucerne root rot fungus *Helicobasidium purpureum* [loc. cit.] was recorded from a second locality during the year.

The control measures for squirter disease of bananas [ibid., xi, p. 794], originally worked out by the Plant Pathological Section, have been extensively practised with pronounced success in districts suffering losses from the disease.

In a further experiment on the control of brown spot [due to an unknown cause: ibid., xvi, p. 451] and black spot [*Phoma citricarpa*: loc. cit.] of citrus, it was shown that home-made cuprous oxide mixture (previously referred to as colloidal copper) [ibid., xvii, p. 376] is effective at a strength of 3 to 40 or even 3 to 80 in controlling melanose [*Diaporthe citri*: loc. cit.] also. A repetition of previous outbreaks of lemon rind breakdown is reported. In addition to the influence of prolonged periods of rain or dew deposition, a nutritional factor is now considered to be of fundamental importance in connexion with this disorder.

Field observations on the brown speck of pineapples, due to *Penicillium* sp. and *Fusarium* sp. [ibid., xix, p. 459], indicated that an insect agency is not necessary for penetration to take place. The degree of infection with pineapple marbling [loc. cit.] is stated to be determined by age of the fruit, meteorological conditions, and certain obscure characteristics of the flower and fruit.

A detailed survey of practically all farms from which serious losses from pineapple water blister (*Thielaviopsis* [*Ceratostomella*] *paradoxa*) [loc. cit.] were being reported showed a definite correlation between the cleanliness in and around the packing shed and the extent of losses sustained. In laboratory tests on the control of side [as distinct from stem-end] infections by *C. paradoxa*, a solution of benzoic acid in alcohol was very effective, but its value from an economic standpoint has not yet been determined. Top rot of pineapples (*Phytophthora*

*cinnamomi*) [ibid., xiv, p. 458] is stated to cause increasing losses in young pineapple plantings.

Previous conclusions regarding the pathogenicity of *Ascochyta caricae* and an [undetermined] species of *Gloeosporium* to papaw were confirmed, the latter fungus being the more important of the two. A species of *Phomopsis* was found to cause a distinctive type of spotting in papaw during the spring months. Evidence was obtained that dead leaf stalks and other parts constitute the source of inoculum of these fungi. Papaw die-back [loc. cit.] was generally less prevalent than in 1939, but in some areas losses of from 8 to 10 per cent. of the plants were observed. Yellow crinkle of papaw [loc. cit.] was unusually prevalent, up to 30 per cent. of the trees being affected in some plantings. Field observations showed that powdery mildew of papaw [*Sphaerotheca* sp.: ibid., xv, p. 281] may be active and harmful as late as the end of September. It is advisable, therefore, to prolong dusting operations accordingly.

The results obtained with soil treatment with sulphur for the control of bacterial wilt of tomatoes [*Bacterium solanacearum*: xiv, p. 337] were inconclusive. In varietal resistance trials the most promising proved to be Sensation, Homer, Marvana, and Denisonia. Widespread outbreaks of a bacterial spot of tomatoes apparently caused by *Bact. vesicatorium* are reported.

Chlorosis in hoop pine [*Araucaria cunninghamii*: ibid., xix, p. 460] nurseries was shown by means of leaf injections to be due in most cases to an iron deficiency closely linked with high salt concentrations in the water used for irrigation.

On pp. 11–12 of this report H. K. Lewcock gives results of pineapple disease work. In further trials on the control of 'crookneck' [ibid., xix, p. 459] soil applications of copper and zinc together gave a better response than either zinc or copper alone. Copper treatment retarded the appearance of 'crookneck' symptoms by three months, but subsequently disease developed in all plots except in those treated with both zinc and copper. Plants treated with copper grew consistently at a faster rate than control plants receiving equivalent amounts of fertilizer, and, in absence of 'crookneck', the leaves were broader, deeper in colour, and more spreading. Inoculation experiments showed that pineapple fruits harvested from plots receiving no added nitrogen during growth were more susceptible to infection with the water blister fungus *C. paradoxa*, than those from plots receiving the heaviest applications of sulphate of ammonia (4,300 lb. per acre), thus contradicting the view prevalent among growers that heavy fertilizing with sulphate of ammonia leads to increased losses from this disease. In further investigations of pineapple black heart [ibid., xix, p. 459] a correlation was found to exist between the sugar-acid ratio of the fruit tissues and the occurrence of the disease. Fruits relatively high in acid content but low or moderate in sugar developed black heart under conditions where fruit with a low acid but the same sugar content remained sound. Since decomposition of acids and accumulation of sugars occur at the same time during the final stages of ripening, it is concluded that the development of black heart can be correlated with a derangement of the normal ripening process and the immobility of the sugar contained in the leaves. The

nitrogen content of sound fruit was found to be appreciably higher than that of diseased, and a positive correlation apparently exists between the carbohydrate and nitrogen contents.

LARTER (L. N. H.). **Report of the Plant Pathologist.**—*Rep. Dep. Sci. Agric. Jamaica, 1939–40*, pp. 22–23, 1940.

During the period under review [cf. *R.A.M.*, xix, p. 260], Panama disease of bananas (*Fusarium* [*oxysporum* var.] *cubense*) continued its spread through the plantations, the number of cases treated being 906,613, representing about the same percentual increase as for the last three years. Infected planting material is no doubt still largely responsible for the dissemination of the disease.

In a report by the Leaf Spot Control Officer on pp. 23–24 information is given concerning the administration and expenditure of the Banana Leaf Spot Control Board, appointed in July, 1939, to supervise the outlay of a grant of £200,000 made by the Government to the banana industry with a view to the establishment of control measures against leaf spot (*Cercospora*) [*musae*]. The area that can be sprayed under the scheme with Bordeaux mixture or perenox (provided by the Board) has been greatly increased by economies in procedure effected as a result of experience gained during the operation of the project. The total outlay from 8th August, 1939, to 30th March, 1940, amounts to £96,981 1*s*. 7*d*.

Bronze leaf wilt [ibid., xx, p. 112], the most serious disease of coconuts in the Island, is still spreading in the north-west, where some 1,000 acres out of the 4,000 affected have been destroyed since the beginning of the epidemic in 1934.

Direct control of pimento (*Pimenta officinalis*) rust (*Puccinia psidii*) [ibid., xix, p. 261] appears to be impracticable, but so far the disease has not developed in a serious form at altitudes below 1,000 ft., and some degree of recovery has been observed at higher elevations.

Among other diseases investigated during the period covered by the report were wither tip of lime (*Gloeosporium limetticolum*) and *Zinnia* [? *elegans*] leaf spot (*C. atricincta*) [ibid., xvi, p. 128].

**Fifty-third Annual Report Colorado Experiment Station 1939–1940.**—61 pp., 1940.

The following items of phytopathological interest occur in this report [cf. *R.A.M.*, xix, p. 328]. At the close of a two-year test period, Montmorency sour cherry trees heavily mulched with straw remained virtually free from chlorosis, which severely affected 12 per cent. of those grown under continuous clean cultivation.

Losses from bacterial ring rot of potatoes [*Bacterium sepedonicum*: see below, p. 176] may be minimized by the use of disease-free seed, the disinfection of cutting knives, the warming-up of seed before planting, the discarding of all slow-sprouting and dormant tubers, and seed treatment after cutting.

Lines of onions withstanding infection by purple blotch [ibid., xiv, p. 222] are now available, and are being used to develop varieties combining resistance to this disease and to thrips infestation.

KEVORKIAN (A. G.). **Plant-disease investigations.**—*Rep. P.R. agric. Exp. Sta., 1939*, pp. 117–119, 2 figs., 1940.

During the period under review [cf. *R.A.M.*, xix, p. 201], *Cercospora musae* was observed to be present in isolated banana plantations over a wide area of Puerto Rico and the Caribbean zone, no serious losses, however, having yet been reported in connexion with the disease.

A new disease of vanilla, involving the abscission of the undeveloped flowers and pods, was investigated at Villalba and Mayaguez, 31 per cent. of the 250 plants examined in a pollination test at the former place being affected. The first symptoms usually appear at the apical end of the racemose inflorescence, affecting the young undeveloped flower buds, and extend towards the proximal end of the peduncle, causing necrosis and darkening of the tissues of the successive buds encountered. Flowers that have reached maturity before the onset of infection are shed, while in the case of young pods developing from the pollinated blossoms, necrosis starts at the proximal and advances towards the distal end. Affected young pods fall prematurely. The disease may also assume another form, in which small, dark spots are produced on the young pods or on the unfertilized ovaries of the epigynous flowers, and gradually expand until the proximal ends of the pods shrivel and abscission takes place. This type of infection, affecting only individual pods and not the entire cluster, is less serious than that first described. Attempts to demonstrate the pathogenicity of various fungi isolated from the diseased tissues have so far given uniformly negative results.

GRANOVSKY (A. A.). **The relation of subterranean insects to the Raspberry crown gall.**—*Hoosier Hort.*, xxii, 5, pp. 67–69, 1940.

In experiments in progress since 1931 at the Minnesota Agricultural Experiment Station, 1,000 raspberry plants from seven to ten fields were examined annually for crown gall (*Bacterium tumefaciens*) infection, the following percentages of which were found in certain rotations: after small grains, 2·88; lucerne, 5·35; grains with a considerable proportion of weeds, 7·47; Kentucky bluegrass [*Poa pratensis*] pasture (four fields), 46·57, 54·87, 35·43, and 23·65, respectively; old raspberry plantation, 5·30; and two-year sweet clover [*Melilotus*], 2·13. The great abundance of insects in raspberry plantations established on bluegrass sod is believed to be responsible for the high incidence of crown gall, the agent of which enters the roots through the injuries inflicted by white grubs, wireworms, larvae of root-feeding beetles, maggots of fungus gnats and of other Diptera, soil nematodes, and earthworms.

NEISH (A. C.) & HIBBERT (H.). **Effect of crown gall formation on the chemical composition of Beets.**—*Canad. J. Res.*, Sect. C, xviii, 12, pp. 613–623, 1940.

Analyses made in Canada of the tumorous tissue produced on beet by inoculation with *Phytomonas* [*Bacterium*] *tumefaciens* [*R.A.M.*, xvi, p. 303; xvii, p. 285], normal tissue of tumorous beets, and that of healthy controls dried at 60° C. in a vacuum oven, showed the following changes in the chemical composition of diseased roots, the results

being expressed as percentages of dry matter. The tumours have a higher content of crude protein, ether extract, starch, pectins, pentosans, cellulose, lignin, methoxyl, polyuronides (of holocellulose), and total ash than healthy beets, although the latter have a considerably higher content of sucrose. The normal tissue of diseased plants was intermediate in composition between healthy and tumorous tissue, except that it had the lowest amount of pectins and total uronic anhydride. The average undried infected beet root was found to be heavier (26·07 gm.) than the healthy one (17·97 gm.) and to contain only about half as much sucrose as the latter, but a greater total amount of solid matter. The cells of the tumours proved richer in protoplasm than those of mature normal tissue. It is concluded from these results that the crown gall organism stimulates the growth of tumour cells only; that the cells of the tumours actively convert sucrose into new protoplasm and cell wall material, one of the major metabolic processes in tumours being the conversion of sucrose into protein; and that the increased dry weight of tumorous roots is due to synthesis in the tumours, the rest of the root being stunted.

VOELCKER (O. J.). **A review of Cacao selection in the Cameroons.**—*Trop. Agriculture, Trin.*, xvii, 12, pp. 223–225, 2 graphs, 1940.

Records taken at the German cacao plantation 'Westafrikanische Pflanzungs-Gesellschaft Victoria', in the British Cameroons, from 1930 to 1933 indicate that pod colour is in no way related to the susceptibility of cacao to the pod disease [*Phytophthora palmivora*: *R.A.M.*, xvii, p. 297], which is stated to destroy approximately 50 per cent. of the crop.

SUKHOV [SOUKHOFF] (K. S.) & SUKHOVA [SOUKHOVA] (Mme M. N.). **Interrelations between the virus of a new grain mosaic disease (zakuklivanie) and its carrier Delphax striatella Fallen.**—*C.R. Acad. Sci. U.R.S.S.*, N.S., xxvi, 5, pp. 479–482, 1940.

In continued studies on the 'zakooklivanie' [pupation disease: *R.A.M.*, xviii, p. 666; xix, p. 336] at Omsk [West Siberia] in 1939, the authors reared a non-infective generation of *Delphax* [*Delphacodes*] *striatella*, the vector of this virus disease [loc. cit.] on healthy oats grown in isolation. The oat plants remained healthy in spite of the large numbers of these 'sterile' insects, thus showing that the pupation disease is not due to a toxic effect produced by the insect. The infectivity of the pupation disease was proved when larvae of some of these insects were placed on diseased oats and after varying periods transferred to healthy plants, with the result that from 7·6 to 70 (average 32·2) per cent. of the larvae were found to have become infected.

The incubation period in the insect varied widely, averaging from 12 to 16 days, but it was never less than six. Owing to the length of the incubation period, the larvae in their various instars showed a different rate of infection, which was practically nil in the first, but increased with each subsequent instar and reached its maximum in the imago. The rate of infection, however, never exceeded 37 per cent. either under laboratory or field conditions. The larvae were most liable to become infected in their early (first and second) instars, while in the fifth

instar or the imago stage the insects were practically immune. This may furnish an explanation of the fact that in oat fields completely infected by the disease, the number of infective insects diminishes gradually, dropping from 30 to 4·7 per cent. by the end of June. But even in their earlier instars the larvae did not easily become infected; none showed traces of infection after one hour's feeding on diseased oats and only an insignificant percentage after six hours, the highest percentage being reached after two to three days. On the other hand, the infection is easily transmitted by infected insects to healthy plants, in some cases in five or ten minutes. The virus does not multiply in the insects, and in time they lose their infective capacity. That the virus is not transmitted to the next generation was proved by an experiment in which the eggs of ten infected females were transferred to healthy oat plants, more than a hundred larvae being obtained from them; none of these larvae carried the infection.

The ratio of infected insects varied with different fields and different crops in direct proportion to the amount of infection in a given field and crop. Thus, in a field of early oats infected to the extent of 100 per cent., the ratio was between 30 and 37 per cent.; on late oats infected to the extent of 25 per cent., it was 8·5 per cent.; while it was only 4 per cent. on rye, which is generally far less susceptible to infection. When 108 larvae, collected from dry oat stubble on a fallow land devoid of any vegetation just as they were emerging from their winter anabiosis, were transferred to healthy oats growing in isolation, 20·3 per cent. of the larvae were found to be infected. This is taken to indicate that the virus overwinters largely in the body of the insect. Later on, another possibility of overwintering was found in the perennial grasses, such as *Agropyron repens* and *Bromus inermis*, which were, however, infected only to the extent of less than 0·01 per cent. and therefore could not constitute a significant mode of overwintering. The virus was furthermore discovered in the annual weeds *Setaria viridis* and *Panicum* [*Echinochloa*] *crus-galli*, the former representing a serious source of infection because very susceptible to the disease and very attractive to the vector. In experiments with rice, 15 per cent. of the material was successfully infected, while attempts to infect soy-bean failed. The penetration of the virus into the tissues of the oat plant was found to proceed at a rate of 7 cm. per hour.

Sukhov [Soukhoff] (K. S.) & Petlyuk (P. T.). **Delphax striatella Fallen as vector of the virus disease 'zakuklivanie' in grains.**—*C.R. Acad. Sci. U.R.S.S.*, N.S., xxvi, 5, pp. 483–486, 1940.

Investigations into the life habits of the vector of 'zakooklivanie' [pupation disease: see preceding abstract], *Delphax* [*Delphacodes*] *striatella*, showed that the larvae of this insect overwinter on weeds and grasses in field boundaries and meadows adjoining oat and other cereal fields harvested the preceding year. More larvae were found near the boundaries of the fields than further away from them, and as far as could be ascertained, the insects followed the direction of the wind. An oat field protected by a gauze fence 2 m. high escaped infection and no insects were found in it; unprotected oat fields, on the other hand, were infected to an extent of 17 per cent. It is suggested that live hedges may provide

considerable protection against the swarms of the insect. Thus, in an oat field infected to an extent of 90 per cent., patches surrounded by trees showed only 20 to 30 per cent. infection. The winged insects invaded only early crops, causing from 41·0 to 89·7 per cent. infection, while crops sown on and after 20th May and inspected at the same time as the early ones showed from 3·8 to 10·0 per cent. Furthermore, in the early crops the oat plants were almost entirely dwarfed, while in the late they were mostly of normal size. In years with exceedingly large populations of the insect, the difference in the rate of infection between the thickly and sparsely growing plants is not considered significant, but in seasons with a moderate population, the rate of infection in the former was 30 to 40 per cent. lower than in the latter. While the time and density of sowing therefore are not factors of primary importance, they exert an indirect effect on the reproduction and activity of the insect, and thus influence the rate of infection, which is obviously correlated with the density of insect population.

It is concluded from these observations that the primary task in controlling pupation disease is the destruction of its vector by applying insecticides to the narrow strips of ground where the insect overwinters.

Zazhurilo (V. K.) & Sitnikova (Mme G. M.). **Mosaic of spring cereals in the Voronezh district.**—*C.R. Acad. Sci. U.R.S.S.*, N.S., xxvi, 5, pp. 474–478, 2 figs., 1940.

In the present paper the symptoms of mosaic, previously reported on winter wheat and rye in the Voronezh district of the U.S.S.R. [*R.A.M.*, xix, p. 268], are described on spring crops, among which hard and soft wheats, oats (*Avena sativa*, *A. byzantina*, and *A. fatua*), and barley were attacked. The symptoms produced on spring cereals differ in some respects from those on winter wheat, although the pattern of the injured leaf blade is of the same type. The colour of the mosaic spots varied with the crop and even with the variety: it was yellow in hard wheats (often of a lemon shade) and green in soft; in oats and barley it was greenish-yellow, one or other of the two colours being predominant at times. In spring crops, the blade of the upper leaves was more affected with mosaic than those of the lower; in winter wheat the upper leaves were less affected than the lower ones or not at all. The diseased plants are retarded in their development and only rarely do they form grain. Most succumb at or before the earing stage. Profuse branching, characteristic of mosaic-infected winter wheat and of spring wheat infected with 'zakooklivanie' [pupation disease: see preceding abstract], was never observed in spring wheat, barley, or oats, nor were there antholysis and proliferation of flowers, typical of the latter disease in both winter and spring crops. No protein crystals were found in affected spring crops. All attempts to transmit the mosaic disease through the juice failed. Experiments with infested soil showed that infection is not spread by this means. The disease was successfully transmitted to spring cereals by the insect *Deltocephalus striatus* [ibid., xix, p. 268], 67·5 per cent. of the experimental plants developing infection when the insects were first fed on winter wheat 'rosettes', 32·5 per cent. when they were fed on infected winter wheat, 16·2 per cent. when the insects were taken directly from stubble of

spring and winter wheats, and between 22·1 and 11·4 per cent. when they were taken directly from various crops.

From the results of comparative studies it is concluded that one and the same virus, which may be appropriately called 'virus of winter wheat mosaic', is responsible for mosaic in both the winter wheat and the spring cereals, in spite of differences in the symptoms. On the basis of the symptoms observed in spring crops, the two closely related viruses of winter wheat mosaic and pupation disease can now be clearly differentiated. Profuse shooting appears in spring crops infected by the virus of pupation disease but not in those attacked by that of winter wheat mosaic. On winter wheat and rye, however, the viruses are not so easily distinguished, as profuse shooting may result from infection with either.

JOHNSON (T.) & NEWTON (MARGARET). **Mendelian inheritance of certain pathogenic characters of Puccinia graminis tritici.**—*Canad. J. Res.*, Sect. C, xviii, 12, pp. 599–611, 1 fig., 1940.

In crossing and selfing studies with physiologic races of *Puccinia graminis tritici* [cf. *R.A.M.*, xix, p. 399] at Winnipeg, it was found that their pathogenic properties are inherited, for the most part, in accordance with Mendelian laws. On the wheat variety Kanred the '0' type of infection (absence of rust pustules) proved dominant to the '4' type (large rust pustules), since a race producing '0' when crossed with one producing '4' gave rise to a hybrid producing '0' type. Furthermore, when the hybrid race was selfed, the '0' type occurred approximately three times as frequently in the $F_2$ as the '4' type, the dominance being governed by a single factor. On the wheat variety Mindum the '4' type of infection was dominant to the '1' type (very small pustules) the former occurring about three times as frequently in the $F_2$ as the latter. On the emmer variety Vernal the '1' type of infection was dominant to the '4' type and recurred, in some crosses, about 15 times as frequently in the $F_2$ as the '4' type, rust behaviour apparently being governed by two pairs of factors. From the study of the $F_2$ populations of two crosses between races 9 and 36 it is thought probable that the factors governing the behaviour of the rust on Kanred, Mindum, and Vernal are distinct and inherited independently of each other. On Marquis wheat, the $F_1$ progeny produced an infection type closely resembling that of the maternal parent race, a phenomenon attributed to the influence of the cytoplasm of the maternal parent race. It is concluded from the results of these studies that the binucleate condition of the rust in its uredo stage does not in any way interfere with the expression of dominance and that the genes function in the same way as in uninucleate organisms. The crossing of races and selfing of hybrids may lead to recombinations of existing pathogenic characters that may result in the formation of new physiologic races.

HOLTON (C. S.). **Preliminary investigations on dwarf bunt of Wheat.**—*Phytopathology*, xxxi, 1, pp. 74–82, 4 figs., 1 diag., 1941.

The reticulate chlamydospores of the physiologic race of *Tilletia tritici* [*T. caries*] responsible for excessive dwarfing and tillering of wheat in Washington [*R.A.M.*, xvi, p. 166] failed to germinate under

any of the laboratory treatments tested, but the smooth, hyaline, haploid resting spores occurring among the reticulate forms frequently produced falcate secondary sporidia, borne either on short sterigmata or long, promycelioid structures; isolations from these sporidia gave rise to monosporidial lines of the dwarf bunt race. The mycelium developing from the single sporidia was usually haploid, though an apparently dicaryotic type occasionally arose. The unisexual nature of the monosporidial cultures is indicated by the typical dwarf bunt infection obtained with combinations of such lines and the absence of infection with individual lines. Hybrids between the dwarf bunt race and race 12 of *T. caries* and 9 of *T. levis* [*T. foetens*] were produced by the inoculation of winter wheats with combinations of monosporidial lines, evidence being secured of segregation for chlamydospore morphology and host dwarfing, though the actual mode of inheritance could not be definitely ascertained on the basis of $F_1$ progeny behaviour.

TURNER (ELIZABETH M.). **Ophiobolus graminis Sacc. var. avenae var. n., as the cause of take all or whiteheads of Oats in Wales.**—*Trans. Brit. mycol. Soc.*, xxiv, 3–4, pp. 269–281, 1940 (issued 1941).

This is a full discussion of the writer's studies on a hitherto undescribed variety of *Ophiobolus graminis*, highly pathogenic to oats in Wales, a preliminary announcement of which has already been noticed [*R.A.M.*, xx, p. 12]. Comparative studies on *O. graminis* proper from English wheat and the Welsh variety, which is named *O. graminis* var. *avenae* [with a Latin diagnosis], revealed significant differences in the length and septation of the ascospores, those from isolates of the former measuring 79 to 86 $\mu$ and having 8 to 8·5 septa, and those from isolates of the latter 101 to 117 $\mu$, with 10 to 12·5 septa. In inoculation experiments, Little Joss wheat was susceptible to infection by both groups of isolates, those from wheat being more virulent (up to 59 per cent. infection of secondary roots in one experiment as compared with a maximum of 35 per cent. for the oats strains) but the symptoms were similar in all cases. Oats (Victory, Scotch Potato, New Abundance, and Jubilee Black) proved highly resistant to the English inoculum, the maximum infection caused by which was 20 per cent. on Jubilee Black. On the other hand, the Welsh strain vigorously attacked all the varieties of oats, up to 97 per cent. infection being registered on New Abundance and Jubilee Black, while wheat was relatively resistant (maximum of 35 per cent. infection). Spratt Archer barley was more heavily infected by *O. graminis* from wheat (up to 76 per cent.) than by *O. g.* var. *avenae*, which caused a maximum of 43 per cent. infection.

TERVET (I. W.). **Problems in the determination of physiologic races of Ustilago avenae and U. levis.**—*Phytopathology*, xxx, 11, pp. 900–913, 4 graphs, 1940.

During the years 1933 to 1935 and 1936 to 1939, 17 collections of *Ustilago levis* [*U. kolleri*] and 63 of *U. avenae*, most of them collected in the Mississippi basin, were tested for physiological specialization in Minnesota on eleven varieties of oats. Some of the collections varied in their pathogenicity to the same variety in succeeding years, taking one to two years to become stable in their reaction. This variation may

be due to environmental factors at sowing time and also to the selective tendency of the host variety from which the inoculum was obtained to favour the production of biotypes to which it is most susceptible. Only five of the test varieties proved of value in separating physiologic races of oat smuts [*R.A.M.*, xix, p. 466], namely Anthony C.I. 2143, Gopher C.I. 2027, Rusota C.I. 2343, Iogold C.I. 2329, and Black Mesdag C.I. 1877, on which three races of *U. kolleri* and three of *U. avenae* were differentiated. The varieties Markton, Navarro, and Nakota were immune from all collections, while D.C. II–22–220 resembled Black Mesdag closely in its reaction to smut. Attempts to build up races of *U. avenae*, which attack slightly Bond and Fulgrain, by repeated increase of them on these two varieties have failed.

MELCHERS (L. E.). **The reaction of a group of Sorghums to the covered and loose kernel smuts.**—*Amer. J. Bot.*, xxvii, 9, pp. 789–791, 1940.

A wide range of variation in their reactions to several physiologic races of the covered and loose kernel smuts of sorghum (*Sphacelotheca sorghi* [*R.A.M.*, xix, p. 210] and *S. cruenta*) was shown by a selected group of 36 varieties in four years' (1931, 1932, 1935, and 1936) tests at the Kansas Agricultural Experiment Station [ibid., v, p. 88], Spur feterita C.I. 623, however, being the only one to rank as immune. Certain varieties and selections, e.g., Hegari C.I. 620, Hegari K.B. 36204, White Yolo C.I. 699, and Red Amber × feterita K.B. 2570 and 2501, were found to be more or less susceptible to physiologic races 1 to 3 of *S. sorghi* and 2 of *S. cruenta* [ibid., xi, p. 448; xiii, 227], but not to race 1 of the latter, whereas others, such as Early White milo C.I. 480, are attacked by *S. sorghi* and race 1 but not 2 of *S. cruenta*. Again, Standard Yellow milo C.I. 234, Dwarf Yellow milo C.I. 332, and Standard White milo C.I. 352 are highly resistant to physiologic races 1 and 2 of *S. cruenta* but susceptible to race 2 of *S. sorghi*, the so-called 'milo race'. Races 2 and 3 of *S. sorghi*, when used together with 1 to produce a composite inoculum, were found to sustain no loss of virulence as a result of the admixture, infecting their differential varieties in the ordinary way.

**Mould growth in sliced bread.**—*Aust. Baker*, xliv, pp. 11–14, 1940. [Abs. in *Aust. chem. Abstr.*, ii, p. 29, 1940.]

An account is given of experiments in Sydney on the control of bread moulds, very promising results in the elimination of which have been secured by the addition to the dough of sodium propionate [*R.A.M.*, xix, p. 589 and below, p. 173], though certain complications in the normal processes of manufacture were simultaneously introduced. White distilled malt vinegar (5 per cent.) was also found to serve as a mould inhibitor.

BLISS (D. E.). **Relation of soil temperature to Armillaria root rot in California.**—Abs. in *Phytopathology*, xxxi, 1, p. 3, 1941.

Sweet and sour oranges (*Citrus sinensis* and *C. aurantium*) grown in a greenhouse in Wisconsin tanks with constant soil temperatures from 10° to 38° C. were inoculated by placing in the soil, after the plant was

well established, a pure culture of *Armillaria mellea* on portions of citrus roots. Severe infection developed after 14 months at 10°, moderate at 17°, and slight at 24°. After seven months Lovell peach and Royal apricot seedlings and rooted geranium (*Pelargonium hortorum*) cuttings showed moderate infection at 10° and severe at 17° and 24°. At 31° the inoculum was not viable, and all the roots remained healthy; at 38° the roots also succumbed. The maximum root growth of the oranges was made at 24° and 31° and that of the peach seedlings at 10° and 17°, while the apricots and geraniums throve best at 17°. Rhizomorphs of *A. mellea* developed in glucose-potato agar at 10° to 31°, with an optimum between 20° and 24°. The mean weekly soil temperatures in a citrus orchard at Anaheim, California, in 1939, ranged from 9·4° to 29·4° at 6 in. and from 13·3° to 20° at 8 ft.

WIEHE (P. O.). **Le 'knife cut' du Cocotier.** [Coco-nut 'knife cut'.]—*Rev. agric. Maurice*, xix, 3, pp. 101–103, 4 figs., 1940.

A description is given of the symptoms of 'knife cut', an apparently hitherto undescribed coco-nut disease of obscure origin first observed in Mauritius in 1931, again noticed in 1937, and more closely investigated by the writer in 1938. Horizontal lesions resembling cuts, up to five per palm, exuding a brownish gum and frequently giving rise to adventitious roots, develop in acropetalous succession on the internodes of the trunk. The presence of *Ceratostomella paradoxa* in the apical leaf sheath tissues and in those of the periphery of the trunk is considered to be without etiological importance. The only control measures that can be recommended at the present stage of the investigations are regular inspections of the plantations, so that the lesions may be promptly detected, excised, and immediately burnt, the exposed portions of the trunk being disinfected by flaming with a torch and the application of hot tar, and the cavities subsequently filled with cement.

KNIGHT (R. L.) & CLOUSTON (T. W.). **The genetics of blackarm resistance. II. Classification, on their resistance, of Cotton types and strains. III. Inheritance in crosses within the Gossypium hirsutum group.**—*J. Genet.*, xli, 2–3, pp. 391–409, 3 graphs, 1941.

In Part II of these studies in the Sudan [*R.A.M.*, xviii, p. 796], over 160 varieties and strains of cotton are classified according to their resistance to blackarm (*Bacterium malvacearum*). In the American Upland group (*Gossypium hirsutum*) resistance ranged, in pure types, from grade '3' to '10' (grade '0' representing immunity and '12' full susceptibility) with some fully susceptible plants in types impure for resistance. The *G. purpurascens* group appeared to contain little, if any, resistance. In the *G. punctatum* group Gambia native and XBA 22039 showed outstanding resistance, the strongest so far found in New World types. Complete immunity was not found in any of the New World types, but it exists in some of the Old World species (Abu Hareira, *G. cernuum*, and *G. sanguineum*). Several of these results conflict with those obtained by other workers (e.g., Harland, Evelyn, and Burd at St. Vincent). It is suggested that in the absence of a standardized inoculation technique, the results are often based on differences in primary (seed) infection rather than on true tissue resistance,

and that the amount of primary infection is probably greatly influenced by the degree of seed fuzziness and plant vigour.

In Part III the type of blackarm resistance inherited in the crosses Uganda B. 31 × 514 and B. 31 × 513 (all three American Upland types) is described and the results are supported by the evidence obtained in unpublished work on crossing 513 with Sakel. Uganda B. 31 is stated to contain resistance factors $B_1$ and $B_2$ [loc. cit.] plus modifiers and to show grade '3' resistance; 514 contains no major resistance factors but numerous minor, chiefly recessive ones and shows grade '10' resistance. The first back-cross to 514 gave a bimodal curve with peaks at grades '4' and '9' and displayed an approximate 1 : 1 ratio instead of the 3 : 1 ratio expected. In $F_2$ and in the $F_2$ of this first back-cross, bimodal curves were again obtained, but these somewhat resembled the 12 : 3 : 1 ratio expected. The 513 parent, a selection from a Punjab American Upland importation with grade '5' to '6' resistance, contains factor $B_2$ together with several very weak factors for resistance. From the genetical data available it is concluded that it is impossible to combine the resistance of 513 with that of Uganda B. 31 in new strains.

Clouston (T. W.) & Andrews (F. W.). **Section of Botany and Plant Pathology, Agricultural Research Service.**—*Rep. Dep. Agric. For., Sudan Govt, 1938*, Part II, pp. 32–47 [? 1940. Received February, 1941].

During the period under review the incidence of cotton blackarm [*Bacterium malvacearum*: *R.A.M.*, xviii, p. 390] was generally low owing to the absence of late rains in most districts of the Sudan. The best results in the control of infection by chemical means were given by two hours' immersion of undelinted Gezira Research Farm seed in a 1 in 500 solution of mercuric chloride-iodide, followed by drying in the sun, the percentages of blackarm in three beds being reduced from 8·5, 18·5, and 43·2 to 0·06, 0·03, and 0·02, respectively. Using delinted seed and 1 in 1,000 mercuric chloride-iodide, the corresponding reductions in two beds were from 39·5 to 0·03 and from 54·4 to 0·008 per cent., respectively. The treatment did not impair germination. In two sets of test plots inoculation by spraying with *Bact. malvacearum*, resulting in an outbreak of mild to moderate intensity, caused a reduction of yield in Sakel of from 3·42 to 2·94 kg. per feddân [1 feddân = 1·038 acre] and in × 1530 of from 3·53 to 2·75 kg. per feddân. Leaf debris exposed on 5th May was found on 1st August to contain no infection, and similarly negative results were obtained in the examination of soil dust from the surface of two plots occupied by severely diseased plants [see next abstract].

The unidentified fungus referred to as 'XT' and related types again predominated among the isolations from the discoloured rootlets of wilted plants, other organisms present in which included *Fusarium*, *Cylindrocarpon*, and *Pythium* spp., *Rhizoctonia* [*Corticium*] *solani*, *Macrophomina phaseoli*, and culture RE/4–58 (probably a saprophyte), the last-named being also the principal occupant of rotted secondarily thickened roots. There is some evidence in favour of the view that the initial decay in cases of root rot is associated with adverse soil factors in the upper layers (18 to 30 in.) causing a restriction of soil moisture

circulation, the rot resulting probably from interference with the oxygen supply to the roots, or the dilution or removal of salt accumulations or root secretions. Rotting of this type may be an annual occurrence, but wilting only occurs when fungi of the *Rhizoctonia* group are present in the soil and invade the decayed tissues, eventually inactivating the root system. The optimum soil moisture content for shoot development in cotton plants growing in the top 4 in. of Gezira soil in petrol tins was found to range from 40 to 45 per cent., an excess being more conducive to poor growth and fungal infection than a deficiency. Although the weight of the fine roots produced at a soil depth below 2 ft. was only a third to a quarter of that attained by those in the surface 6 in., the latter were much more discoloured and of a less healthy appearance than the deeper ones. In tests in which seedlings grown in sterile sand were watered with (*a*) sterile soil extract and (*b*) a sterile mineral nutrient solution, with the addition of a small quantity of sterilized soil, the roots remained free from infection, whereas those receiving an admixture of unsterilized soil were fairly heavily invaded by fungi. The pathogenicity of individual root isolations may in future be tested by this method.

Brown (J. G.). **Wind dissemination of angular leaf spot of Cotton.**—Abs. in *Phytopathology*, xxxi, 1, p. 4, 1941.

The dissemination of angular leaf spot of cotton (*Phytomonas malvaceara*) [*Bacterium malvacearum*] by the wind was demonstrated over an area of 1,100 acres [? in Arizona], the inoculum being carried in dust. Extensive infection developed in cotton plants injured by a hailstorm a week before the gale. The circumstances attending these field observations rendered them fairly comparable to a planned laboratory test.

Luthra (J. C.) & Vasudeva (R. S.). **Mixed cropping and the Cotton root rot disease (Macrophomina phaseoli and R. solani).**—*Curr. Sci.*, ix, 10, pp. 466–467, 1940.

Particulars are given of experiments conducted at Lyallpur to determine the effect of mixed cropping on the cotton root rot caused by *Macrophomina phaseoli* and *R*[*hizoctonia* = *Corticium*] *solani* [*R.A.M.*, xix, p. 90], sorghum J 20 being sown broadcast between the rows of [*Gossypium*] *mollisoni* 39 in a thoroughly infested field in May, 1939, and a 2 ft. border of the cereal also sown all round the cotton crop. Another set of plots was sown with cotton alone for control purposes, and weekly counts were made of the incidence of mortality from root rot between 20th June and 11th September. The maximum percentage of dead plants in the pure cotton stand (12·47) was recorded on 26th June and 8th August, the total for the season (average of 13 counts) being 68·5, as against only 3·4 in the mixed stand. Similar results were obtained in experimental stands of mixed cotton of the same variety and *Phaseolus aconitifolius*.

Rosenfeld (G.). **Paracoccidioides brasiliensis.**—*Rev. clin. S. Paulo, 1940*, p. 197, 1940. [Portuguese. Abs. in *Bol. Ofic. sanit. panamer.*, xix, 10, p. 1015–1016, 1940.]

The occurrence of *Paracoccidioides brasiliensis* [*R.A.M.*, xx, p. 116]

in the blood stream in cases of ganglionary blastomycosis in Brazil is discussed.

CARRIÓN (A. L.). **The specific fungi of chromoblastomycosis.**—*Puerto Rico J. publ. Hlth*, xv, 4, pp. 340–361, 5 pl., 1940.

This is a comparative study of 28 fungi isolated from cases of chromoblastomycosis [*R.A.M.*, xx, p. 16] in ten countries: five of the organisms are referred on the basis of their mode of sporulation to *Phialophora verrucosa*, 22 to *Fonsecaea pedrosoi* (Brumpt) Negroni, 1936, emend., and one to *F. compactum* Carrión, 1935, comb. nov. [but see ibid., xix, p. 557]. Two varieties of *F. pedrosoi* are described [with Latin diagnoses], namely *F. pedrosoi* var. *cladosporioides* (syn. *Hormodendrum algeriensis* [ibid., vii, p. 639] and *Phialoconidiophora guggenheimia* [ibid., xvii, p. 812]) and *F. pedrosoi* var. *communis*, respectively; the former includes isolates in which the sporulation is mostly of the *Hormodendrum* (*Cladosporium*) type and the latter comprises a large number of intergrading forms in which both the *Hormodendrum* and pseudo-*Acrotheca* types of sporulation are abundantly represented. It has been clearly demonstrated that the existing differences between the agents of chromoblastomycosis reside merely in the proportion, and not in the nature, of the methods of sporulation. *F. pedrosoi typicus* [i.e., typical *F. pedrosoi*] embraces a number of species erroneously described as independent, including *Acrotheca pedrosoi* [ibid., xvi, p. 99], *Trichosporium pedrosoanum*, *Botrytoides monophora* [loc. cit.], and *Hormodendroides pedrosoi* [ibid., xvi, p. 251].

Without questioning the possible existence in chromoblastomycosis of other etiological species in addition to those comprising the three specific groups herein discussed, the author is of the opinion that most of the organisms to be isolated from future cases of the disease will fall into one or the other of these categories.

MACKINNON (J. E.). **Micosis autoctonas en Uruguay.** [Indigenous mycoses in Uruguay.]—*An. Fac. Med. Montevideo*, xxv, p. 53, 1940. [Abs. in *Bol. Ofic. sanit. panamer.*, xix, 10, p. 1017, 1940.]

The author presents a bibliography of indigenous Uruguayan mycoses, together with *inter alia*, an analysis of ten cases of favous tinea involving three separate sites and caused by *Achorion milochevitchii* [*R.A.M.*, xvii, p. 38], diagnostic observations on generalized epidermomycosis and onychia associated with *Trichophyton rubrum*, and a report of pityriasis versicolor [*Malassezia furfur*: ibid., xx, p. 117] affecting 0·5 per cent. of the inmates of a skin clinic. The first case of chromoblastomycosis (*Phialophora verrucosa*) [see preceding abstract], and incidentally the first record of the disease in South America, was recorded in Uruguay in 1933 [ibid., xiv, p. 509]. Sporotrichosis [*Sporotrichum* spp.] occurs with relative frequency, 32 cases having been diagnosed.

JOACHIM (H.) & POLAYES (S. H.). **Subacute endocarditis and systemic mycosis (Monilia).**—*J. Amer. med. Ass.*, cxv, 3, pp. 205–208, 7 figs., 1940.

This is a detailed account of a fatal case of subacute endocarditis

and systemic mycosis, attributed to infection by an unidentified species of *Monilia* [*Candida*] in a 48-year-old man at Brooklyn, New York. The fungus, cultured on Sabouraud's medium, consisted of ovoid elements, averaging 4 $\mu$ in diameter, with atypical short mycelia and distinct indications of hyphae in one of the subcultures; reproduction was effected by budding. At 37·5° C. nutrient, dextrose, and blood agar media gave rise to opaque, yellow, convex, round, non-haemolytic colonies after 48 to 72 hours. This is believed to be only the second case of the kind reported in the literature, and in the first (*Arch. Path. Lab. Med.*, xxvii, p. 394, 1939) the causal organism was not isolated or identified.

NEGRONI (P.) & TEY (J. A.). **Estudio micológico del primer caso argentino de micetoma maduromicósico de granos negros.** [Mycological study of the first Argentine case of maduromycotic mycetoma with black grains.]—*Rev. Inst. bact., B. Aires*, ix, 2, pp. 176–189, 6 figs., 1939. [French and English summaries.]

A description is given of the first case on record in the Argentine of Madura foot, a microscopic examination of the black grains, 3 mm. in diameter, associated with which revealed a septate mycelium, 3 $\mu$ in diameter and chlamydospores, up to 20 $\mu$ in diameter, enclosed in an amorphous, brown, intercellular substance. The fungus was cultured and identified as *Aspergillus chevalieri* [*R.A.M.*, xviii, p. 255].

MINCHEW (B. H.), COLLINS (B. E.), & HARRIS (M. M.). **External ear disease with special reference to the fungous type.**—*Sth. med. J.* (*J. sth. med. Ass.*), xxxiii, 12, pp. 1345–1348, 1940.

Of 93 suspected cases of otomycosis investigated at the Georgia State Health Department in 1939, 27 (30 per cent.) revealed fungal involvement of the ear canal, associated with *Aspergillus flavus* (10), *A. fumigatus* (5), *A. sydowi* (4), *A. niger* (3) [*R.A.M.*, xix, p. 703], *A.* sp. (4), and *Penicillium* sp. (1). The relative absence of organisms of this group from normal ears and from the skin is regarded as suggestive of etiologic significance in troubles of the auditory canal.

HOFBAUER (W.). **Die Pilzerkrankungen der Haut.** [Fungous diseases of the skin.]—*Wien. klin. Wschr.*, liii, 14, pp. 280–284, 1940.

This is a useful survey, based on the author's experience at the Vienna University Clinic for Skin Diseases, of the mycological, clinical, diagnostic, and therapeutic aspects of the human skin infections caused by *Microsporon* [*Malassezia*] *furfur*, *Microsporon minutissimum*, *M. audouini*, *M. lanosum*, various forms of epidermophytosis and trichophytosis, including those associated with *Epidermophyton* [*floccosum*], *E.* Kaufmann-Wolf, *Trichophyton gypseum*, *T. rosaceum*, *Achorion schoenleini*, *A. quinckeanum*, and thrush [*Candida albicans*].

DU BOIS. **Le traitement des épidermophyties interdigitales.** [The treatment of interdigital epidermophytoses.]—*Schweiz. med. Wschr.*, lxx, 50, pp. 1223–1225, 1940.

This article is mainly concerned with the clinical and therapeutical aspects of interdigital epidermophytoses but contains the information

that the fungi responsible for the condition in Switzerland are *Epidermophyton inguinale* [*E. floccosum*], *E.* [*Trichophyton*] *interdigitale*, and *E.* [*T.*] *rubrum*. Two cases of the last-named predominantly Asiatic species were observed at Geneva, one in a merchant returned from the East [cf. *R.A.M.*, xvi, p. 459].

ROGERS (RUTH E.), HIRSCHMANN (DORIS J.), & HUMFELD (H.). **Comparison of growth of Trichophyton interdigitale on wool fabric with and without additional nutritive media.**—*Proc. Soc. exp. Biol., N.Y.*, xlv, 2, pp. 729–733, 1 fig., 1940.

An isolate of *Trichophyton interdigitale* from the American Type Culture Collection, 1939, was grown at room temperature on Sabouraud's dextrose, peptone, mineral salts, and water agars, with and without the addition of steam-sterilized ½ in. squares of woollen blanket fabric. The fungus developed on the Sabouraud's and peptone media, but not on the other two, except in the presence of wool, growth on which was apparently stimulated by the mineral salts. The dextrose medium was utilized in preference to the wool, which was readily attacked, however, on the peptone agar.

WU (S. D.) & KUROTCHKIN (T.). **A case of fungus infection of the maxilla due to Spondylocladium-like fungus; a hitherto undescribed lesion.**—*Chin. med. J.*, *Suppl.* 3, pp. 195–197, 2 pl., 1940.

From lesions simulating carcinomata in the nose, right maxillary region, and lymph nodes of the neck of a 28-year-old male patient at the Peiping Union Medical College the writers in 1936 isolated a species of *Spondylocladium*, characterized by dark brown, 3- to 5-cellular conidia, 32 to 36 by 8 to 12 $\mu$, borne directly at the ends of long, broad, branching hyphae. Inoculation experiments on laboratory animals gave negative results.

WALDBOTT (G. L.), ASCHER (M. S.), & ACKLEY (ALMA B.). **Fungi: relation to respiratory allergy.**—*J. Mich. med. Soc.*, xxxix, 9, pp. 645–647, 1 graph, 1940.

A survey of the content of the air for fungus spores was conducted over a period of a year (November, 1937, to November, 1938) at Detroit, Michigan, in a number of different habitats, such as roofs of buildings, shops, stables, libraries, and so forth [*R.A.M.*, xx, p. 15]. Among the perennial fungi, *Penicillium*, yeasts, and *Torula* predominated, while *Alternaria* and *Monilia* [? *Candida*], though present throughout the year, showed a seasonal prevalence from July to November and May to November, respectively. The yeasts and *Torula*, which are regarded as clinically significant, reached their maximum incidence between December and March, when relatively few spores of other genera developed. *Aspergillus*, believed by some to be very abundant, gave relatively low counts throughout the period of the survey.

**Indian Central Jute Committee. Annual Report of the Agricultural Research Scheme for the year 1939–40.**—50 pp., 5 pl., 1940.

Section VII of this report (pp. 26–36), dealing with jute diseases in India, contains the following information. About a fortnight after

sowing at Dacca Farm, Bengal, the initial symptoms of stem rot (*Macrophomina phaseoli*) [*R.A.M.*, xii, p. 267] became apparent in the form of typical damping-off in the collar region of the seedlings, as well as in that of blight, originating in the cotyledonary leaves; in some cases infection had penetrated to the root system. The disease spread in patches of continuously increasing size, and by the time the crop was a month old foliar infection was prevalent, this secondary infection originating from pycnospores borne on necrotic or partially recovered seedlings. Brownish patches developed on the stems as a result of contact with the shrivelled, yellow infected leaves, the epidermis peeling off and exposing the fibrous tissue. At this stage the patch might either extend right round the plant, causing complete desiccation (though the stalks remained standing erect), or the advance of the pathogen might be arrested and the host survived. At the age of 11 weeks, roughly 20 per cent. of the *Corchorus capsularis* plants, comprising the D. 154 and 386 and Fanduk varieties, were diseased as against 12 per cent. among those of *C. olitorius* (R. 26, Chinsurah Green, and Dacca Local). The relative resistance of the latter species in the field, however, was not maintained in inoculation experiments in which 22 varieties of both types were exposed to favourable conditions for infection, namely, warmth and humidity (above 80 per cent.), such as occur in the field during the second half of June and cease after the middle of August. *M. phaseoli* was observed to be much more widespread in late sown upland crops than in those sown early in low-lying areas. Two or three timely thinnings were found to be helpful in the control of stem rot, the incidence of which was also reduced by seed treatment with formalin, mercuric chloride, or hot water (56° to 60° C.), the period of immersion in all cases being 20 minutes. Out of 2,140 seeds examined 1,934 (90·33 per cent.) were found to be healthy, 168 (7·9) were light and shrivelled, 11 (0·52) contained hyphal growths, and 27 (1·25) were occupied by sclerotia, which in some instances had caused disintegration of the cotyledons and endosperm. The seeds containing hyphae gave rise to 100 per cent. diseased seedlings, the corresponding number for the light and shrivelled material being 12·1 per cent. Cross-inoculation experiments with the jute strain of *M. phaseoli* and a culture isolated from severely infected cotton plants [see above, p. 162] showed the former to be the more virulent.

At the inception of the flowering stage in early August yellowish to brownish spots developed on the foliage and later spread to the petioles and stems, frequently involving the desiccation of the axillary and apical buds, and sometimes the shrivelling of the whole plant. The pods of mature plants became infected and bore the pycnidia of *Diplodia corchori*, the pathogenicity of which was confirmed by inoculation experiments.

Considerable variation was observed in the symptoms of chlorosis, possibly a virus disease, which may affect only a single branch. Sudden spread and a tendency to recovery from the disorder was noted; thus, at the age of two months, some 48 per cent. of the plants in a stand (all *C. capsularis*) were affected, whereas three weeks later the incidence had fallen to 30 per cent. The use of a nitrogenous (cattle) manure, either singly or in combination with potash or phosphorus,

was observed to increase the prevalence of chlorosis while diminishing that of stem rot, the best results in the control of which was obtained with a combination of nitrogen, potash, and phosphorus fertilizer plus calcium; a mixture of ammonium sulphate and superphosphate was also beneficial.

**The rot-proofing of sandbags.**—*Chem. & Indust.*, lix, 50, p. 831, 1940.

A cheap and simple method of protecting jute and cotton sandbags against rotting by micro-organisms [*R.A.M.*, xix, p. 538] has been developed by Imperial Chemical Industries. The 'one-bath' treatment, which is estimated to increase the service life of the bags at least eight times at a cost not exceeding $\frac{1}{10}$*d.* per bag, is carried out as follows. A basic copper carbonate suspension is prepared by the slow stirring of $4\frac{1}{2}$ lb. soda ash or $11\frac{1}{2}$ lb. soda crystals in 5 gals. water into a solution of 10 lb. copper sulphate crystals in 30 gals. water, using a wooden (not iron) vessel; the quantity is then made up to 40 gals., 2 oz. calsolene oil HS (an inexpensive wetting agent) added, and the sandbags immersed until thorough saturation is effected. After the removal of excess liquor by wringing or passage through a hydro extractor, the bags should weigh twice their original weight. They are then dried at a low temperature. The period of immersion in cold water should not be less than five minutes, but the process may be expedited by warming the water to 85° to 100° F. Equally good results were obtained by the use of separate solutions of copper sulphate and soda, and this method may be preferable for compact and tightly woven materials or bags in compressed bales. Samples of treated fabrics buried in garden soil for eight months were found to be in excellent condition at the end of the test, by which time the controls were almost entirely disintegrated. [This information is also presented in *Chem. Tr. J.*, cvii, 2795, p. 336, 1940.]

DIMOCK (A. W.). **The Rhizoctonia root rot of annual Stocks (Matthiola incana).**—*Phytopathology*, xxxi, 1, pp. 87–91, 2 figs., 1941.

Nursery gardeners in the eastern United States are stated to incur heavy losses through a destructive foot rot of annual stocks (*Matthiola incana* [var. *annua*]) characterized by girdling of the stem at soil-level and complete foliar wilting, up to 50 per cent. failure in the plantings having been observed during the past two years in New York. One or more strains of *Rhizoctonia* [*Corticium*] *solani* [*R.A.M.*, xv, p. 24] were shown by inoculation experiments to be involved in the etiology of the disease. The pathogen gains ingress to the host at or just below soil-level and may extend through the entire root system, plants of any age up to two months being susceptible. The affected tissues turn black and undergo marked constriction. Unilateral development of the plant frequently follows the initial confinement of the lesions to one side of the stem. The fungus was experimentally shown to spread through the soil at the rate of at least 10 in. per month. The strain of *C. solani* isolated from stocks was proved by inoculation tests to be pathogenic to *Alyssum compactum*, *A. maritimum*, and *Iberis umbellata*. Very satisfactory control of the disease in heavily infested soil was

secured by sterilization with steam or chloropicrin (10 c.c. per cu. ft.) [ibid., xix, p. 611].

MITTER (J. H.) & MITRA (A. K.). **Occurrence of Sclerospora graminicola (Sacc.) Schroet. on Setaria verticillata Beauv. in Allahabad.**—*Curr. Sci.*, ix, 10, p. 461, 1940.

*Sclerospora graminicola*, the agent of green ear disease of *Pennisetum typhoides* in India [*R.A.M.*, xi, pp. 507, 634], has been observed in the conidial stage on *Setaria verticillata* growing in a shady position in the Allahabad University Botanical Gardens. This is apparently the first record of the downy mildew on the host in question.

KADOW (K. J.). **A new spray is born.**—*Amer. Fruit Gr.*, lx, 12, pp. 11, 18, 3 figs., 1940.

During 1940, experiments were carried out in five commercial orchards in Delaware to determine the value of a ground spray of elgetol (sodium dinitro-orthocresylate and a mixture of sodium nitrate with calcium arsenite) in the control of apple scab [*Venturia inaequalis*: *R.A.M.*, xix, p. 353]. Spray equipments with pressures ranging from 400 to 600 lb. were used, both guns and six- to eight-nozzle brooms being tested; the latter proved superior in giving a wider sweep to the fungicide. In one block of 15-year-old Red Delicious trees below which 0·5 per cent. elgetol was applied at the rate of 600 lb. per acre just before the breaking of the leaves, infection on 16th May was only just over 2 per cent., although the regular spraying had not been well timed by the grower, whereas in previous seasons the disease had been too severe to admit of control by spraying. Trees receiving only ground sprays of elgetol showed 4 per cent. leaf infection on 16th May and 67 per cent. fruit scab on 29th August, as compared with 58 and 100 per cent., respectively, on the untreated controls, while the percentage of fruit infection on the trees given both ground sprays and the regular sulphur application was only 29.

WORMALD (H.). **The grey mould of fruit, and some of its host plants.**—*Gdnrs' Chron.*, Ser. 3, cix, 2823, p. 44, 2 figs. (1 on p. 45), 1941.

In the spring of 1940 *Botrytis cinerea* was observed at the East Malling Research Station to be causing an eye rot of half-grown apples still on the tree, similar specimens being sent from Cambridge for examination. The fungus was almost invariably found on the withered calyx lobes, whence it had evidently spread round the eye. Further development, culminating in the complete rotting of the fruits, occurred on a number of such apples transferred to moist chambers. This disease appears to be identical with an eye rot of apples recently described from New Zealand [*R.A.M.*, xix, p. 644]. Strains of *B. cinerea* from seven different hosts were inoculated into apples with positive results.

PLAKIDAS (A. G.). **Infection with pure cultures of Clitocybe tabescens.**—*Phytopathology*, xxxi, 1, pp. 93–95, 1 fig., 1941.

Great difficulty has been experienced in securing the infection of pear and tung [*Aleurites ?fordii*] with *Clitocybe tabescens* [*R.A.M.*, xx, p. 68], the agent of root rot in both these trees in Louisiana. Recently,

however, a very satisfactory method has been devised, similar to that used by H. E. Thomas in his studies on *Armillaria mellea* [ibid., xiii, p. 552], and involving the culture of the fungus on autoclaved thick pieces of either of the two hosts in ½-gal. jars, to which are added a spoonful of maize meal and 250 c.c. water before autoclaving; in four to six weeks the wood becomes permeated by the mycelium and rhizomorphs are produced in abundance. On 17th May, 1938, one out of four eight-year-old Pineapple pears inoculated on 28th September, 1937, was observed to be wilting, and on examination the main roots and the portion of the trunk from the crown to about 12 in. above soil-level were dead. White plaques of rhizomorphs were present between the wood and the bark and between the cortical layers. On 16th April, 1940, one out of six young trees inoculated on 8th February, 1938, was found dying with typical symptoms, a rhizomorphic strand uniting the inoculum with the tap-root at the base of the trunk. Two of the four eight-year-old trees inoculated in September, 1937, were blown down on 29th March, 1940, and their root systems found to be infected, though no external symptoms were apparent. *C. tabescens* was reisolated in all cases from the diseased tissues. This is believed to be the first record of successful infection with pure cultures of the pathogen.

Martin (Ella M.). **The morphology and cytology of Taphrina deformans.**—*Amer. J. Bot.*, xxvii, 9, pp. 743–751, 29 figs., 1940.

A detailed account is given of the writer's studies on *Taphrina deformans* [*R.A.M.*, iv, p. 447], isolated in pure culture from infected Elberta peach trees in various localities in Kansas, Illinois, North Carolina, and Indiana. The binucleate dicaryophase was found to be initiated by a nuclear division in the germinating secondary spore and to continue through the germ-tube, the mycelium, and the ascogenous cells developed from the shorter cells of the subcuticular mycelium, culminating in the fusion of nuclei in each of the last-named. The shorter haploid phase begins with the first division in the ascus and is represented by the eight uninucleate primary ascospores and the secondary spores produced by their budding.

Daines (R. H.). **A new copper spray for Cherry leaf spot control.**—*Hoosier Hort.*, xxii, 7, pp. 105–107, 1940.

The best results in the control of cherry leaf spot [*Coccomyces hiemalis*] with copper fungicides in three years' tests in New Jersey were given by home-made copper phosphate, 2 lb. copper sulphate, 2 lb. trisodium phosphate powder, and 4 lb. hydrated lime being required to make up a solution of 100 gals.; the addition of a spreader, such as orthex, is beneficial. The strong adhesive properties of this mixture, while enhancing its fungicidal efficacy, preclude its use as a pre-harvest spray, for which purpose lime-sulphur is usually adequate: at least two post-harvest applications of copper phosphate should be given, one immediately after the fruit is gathered and the second about three weeks later.

Meredith (C. H.). **The growth of Fusarium oxysporum cubense in the soil.**—*Phytopathology*, xxxi, 1, pp. 91–93, 1941.

The daily average rates of surface spread of *Fusarium oxysporum* var.

*cubense*, the agent of Panama disease of bananas, in a modified greenhouse compost, a mixture of equal parts of coarse river sand and greenhouse compost, and a clay subsoil at the Glenleigh Laboratory, Highgate P.O., Jamaica, were 0·47 cm., 0·36 cm., and 0·3 cm., respectively, over a period of 42 days, the rate of daily spread in different parts of this period ranging from 0·24 cm. to 0·60 cm. The depth of penetration after eight days in thirteen soils varied from 0·3 cm. in a silt loam to 0·52 cm. per day in a coarse sandy loam.

MAGEE (C. J. P.). **Pathological changes in the phloem and neighbouring tissues of the Banana (Musa cavendishii Lamb.) caused by the bunchy-top virus.**—*Sci. Bull. Dep. Agric. N.S.W.* 67, 32 pp., 30 figs., 1940.

Intensive studies at the University of Sydney on Cavendish or Dwarf banana plants suffering from bunchy top [*R.A.M.*, xix, p. 610] showed the most reliable diagnostic symptom to be the characteristic green streaking of the vascular traces in the leaf blades, midribs, and petioles, which is correlated with the partial or total replacement of the normal phloem by a morbid tissue containing obliterated or necrotic areas. The mechanical sheath of the phloem may be lacking or represented only by a few fibres, while the surrounding ground parenchyma is subdivided into a small-celled tissue with a high chloroplast content per given area, which induces the familiar external green streaking.

The foregoing abnormalities arise as a sequel to aberrations in the ontogeny of the phloem and adjacent tissues during the incubation period of the disease, and subsequently with the development of each young leaf, the sieve-tubes apparently providing the channels of ingress for the virus. The primary effect of the infective principle is to induce hypertrophy of the cell volume or the nucleus of any unspecialized cells in proximity to the sieve-tubes, or both, and hyperplasia of the more remote surrounding cells. Since these changes involve the sieve-tube mother cells, young sieve-tubes, companion cells, and phloem parenchyma, very extensive modification of the phloem strands ensues. Moreover, the extension of hypertrophy and hyperplasia to the young mechanical sheath and ground parenchyma entails irregularities in the further development of these tissues. Although the factors underlying these alterations are not fully understood, the possibility is suggested that the virus is a growth-stimulating substance, the relative concentrations of which determine cell response.

The obliteration or necrosis of certain cells may accompany hypertrophy and is followed by the infiltration of mucilage, but phloem necrosis is regarded as of secondary importance in comparison with the other pathological changes discussed. The substitution of a morbid tissue for the phloem is considered to be responsible, by interference with translocation, for the accumulation of starch and crystalline material in the diseased foliage, and ultimately for all the external features of bunchy top.

The histopathology of banana bunchy top is briefly compared with that of potato leaf roll and curly top of sugar beet [ibid., xi, p. 741; xvi, p. 650], and attention drawn to some striking analogies in the activities of the three viruses concerned.

Ruehle (G. D.). **Algal leaf and fruit spot of Guava.**—*Phytopathology*, xxxi, 1, pp. 95–96, 1941.

Guava leaves and fruits in south Florida are stated to suffer heavy damage from infection by *Cephaleuros virescens* [*C. mycoidea*], resulting in partial defoliation and severe blemishing, the large-fruited Peruvian variety being particularly susceptible. The dark greenish-brown to black, slightly raised spots on the fruits are surrounded by irregular, dendritically lobate margins and seldom exceed 2 mm. in diameter; penetration is confined to the first few subepidermal layers. Good control has been obtained by the application, at three- to four-weekly intervals, of 3–3–100 Bordeaux mixture or its fungicidal equivalent in one of the 'neutral' or 'fixed' coppers.

Das Gupta (S. N.) & Verma (G. S.). **Studies in the diseases of Mangifera indica Linn. II. Effect of injecting healthy Mango fruits with extract from naturally occurring necrotic Mangoes.**—*Proc. Indian Acad. Sci.*, Sect. B, xii, 4, pp. 95–108, 1 col. pl., 1 fig., 1940.

Symptoms of necrosis comparable with those occurring under natural conditions in Bihar and the United Provinces were induced in 71 out of 186 (38 per cent.) sound Dasehri and Safeda mango fruits [*R.A.M.*, xviii, p. 329] by the injection through the distal end of the fruits still attached to the tree of extracts (stored or fresh) from diseased tissues, the latter variety being the more susceptible of the two (46·1 as against 20·7 per cent. positive). Control experiments with extracts from healthy mangoes produced necrosis in 4 out of 80 (5 per cent.) Safeda mangoes and 0 out of 10 Dasehri. Most of the affected fruits developed symptoms characteristic of the more advanced (but not the final) stages of the necrosis as observed in the field. Common to both the spontaneous and induced forms of the disease are the scattered grey spots, gradually coalescing into a necrotic area surrounded by an etiolated zone, whereas the water-soaked lesions appearing in response to injection are not typical of the disorder in naturally affected fruits.

Black (L. M.). **Hereditary variation in the ability of the Clover leaf hopper to transmit Potato yellow dwarf virus.**—Abs. in *Phytopathology*, xxxi, 1, p. 3, 1941.

Selective breeding through ten generations resulted in the development of two races of clover leafhoppers (*Aceratagallia sanguinolenta*) one 'active' and the other 'inactive'. Under conditions in which 80 per cent. of the active individuals transmitted the potato yellow dwarf virus (*Marmor vastans*) [*R.A.M.*, xix, p. 724] to crimson clover (*Trifolium incarnatum*), only 2 per cent. of the inactive insects and 30 per cent. of the hybrids between the two races handed on the infective principle. Active individuals appeared in colonies of the inactive race, while conversely, some inactive ones were present among the active. Active insects from an active race were more efficient vectors than those from an inactive (efficiency coefficients 0·53 and 0·68, respectively); while a slightly but significantly higher percentage of males (43 per cent.) than females (38 per cent.) transmitted the virus.

McCallan (S. E. A.) & Setterstrom (C.). **Toxicity of ammonia, chlorine, hydrogen cyanide, hydrogen sulphide, and sulphur dioxide gases. I. General methods and correlations.**—*Contr. Boyce Thompson Inst.*, xi, 5, pp. 325–330, 1 diag., 1940.

McCallan (S. E. A.) & Weedon (F. R.). **Toxicity of ammonia, chlorine, hydrogen cyanide, hydrogen sulphide, and sulphur dioxide gases. II. Fungi and bacteria.**—ibid., xi, 5, pp. 331–342, 1 diag., 11 graphs, 1940.

Full details are given of studies on the relative toxicity of ammonia, chlorine, hydrogen cyanide, hydrogen sulphide, and sulphur dioxide gases commonly occurring in industrial atmospheres to various forms of plant and animal life [*R.A.M.*, xx, p. 128]. Species of pathogenic fungi and bacteria, green leaves and stems, seeds, insects, and rodents were exposed to a continuous flow of gas at controlled concentrations of 1, 4, 16, 63, 250, and 1,000 p.p.m. of air by volume for periods of 1, 4, 15, 60, 240, and 960 minutes. After exposure the presence or absence of growth of the fungi on fresh sterile media was noted. The fungi and bacteria tested were *Sclerotinia fructicola*, *Ceratostomella ulmi*, *Glomerella cingulata*, *Macrosporium* [*Stemphylium*] *sarciniforme*, *Pestalozzia stellata*, *Botrytis* (*cinerea* type), *Rhizoctonia tuliparum*, *Sclerotium delphinii*, *Monilia* [*Candida*] *albicans*, and *Escherichia coli* and comparison of L T 50 values (50 per cent. killed) in minutes at a concentration of 1,000 p.p.m. showed the following order of toxicity of the gases: sulphur dioxide [loc. cit.], chlorine > ammonia > hydrogen sulphide, hydrogen cyanide; to green leaves or stems, chlorine > sulphur dioxide > ammonia, hydrogen cyanide > hydrogen sulphide. The results indicate that, in general, sulphur dioxide and chlorine tend to be the most toxic towards plant life and hydrogen cyanide and hydrogen sulphide the most toxic to animals.

*S. delphinii* and *R. tuliparum* were the most sensitive of the cultures and *Ceratostomella ulmi* and *E. coli* the least. Young cultures were more sensitive than older ones. There was a conspicuous delay in visible growth of viable cultures after transfer to fresh media.

Upholt (W. M.) & Hoskins (W. M.). **Factors concerned in the deposit of sprays. VII. Design and use of a photographic apparatus for studying the impact and movement of individual drops upon a surface.**—*J. econ. Ent.*, xxxiii, 1, pp. 102–107, 2 figs., 3 diags., 1940.

An apparatus is described for taking photographs, with a very brief exposure ($\frac{1}{10000}$ second), of drops of a liquid at any time desired before, during, or after contact with a solid surface, thereby enabling accurate measurements to be made of the advancing and receding angles. The effects of continued spraying may be studied by allowing a given number of drops to strike and move down the surface. The method being relatively cheap, many tests may be made and slight differences in the behaviour of test preparations evaluated with precision.

Miller (F. W.). **Retarding mold in cheese.**—Abs. in *Nat. Butt. J.*, xxxi, 8, pp. 12–13, 38, 1940.

Experiments were conducted at the E.I. du Pont de Nemours Company to determine the effects of propionic acid [see above, p. 160] and

sodium and calcium propionates on the growth of [unspecified] moulds on cheese cuts enclosed in cellophane (300 M.S.T.) bags. Half-pound wedge-shaped pieces (six per treatment) were first exposed to air contamination, then immersed in the treating solution, drained, and finally stored at 58° to 60° F. and 90 per cent. relative humidity. Propionic acid was found to be about twice as effective as the salt solutions for the purpose in view. Treatment in 8 per cent. propionic acid for 15 seconds, followed by a draining period of four minutes, produced a delay of 18 to 21 days in mould development.

FOISTER (C. E.). **War on plant diseases.**—*Scot. J. Agric.*, xxiii, 2, pp. 163–168, 1941.

Attention is drawn to the urgent necessity of stringent safeguards against plant diseases, some of which take a heavy annual toll of Scottish crops and so cause a substantial decrease in the production of home-grown foods. To cite some examples, the average yearly losses from potato blight [*Phytophthora infestans*] and virus diseases each amount to 10 per cent. of the crop, the two together depriving the country of some 180,000 tons of potential produce. Effective control measures against the pre-emergence blight and stripe of oats due to *Helminthosporium avenae* are now in force in Scotland, resulting in a crop of 633,000 tons in 1938, but had the disease been allowed to develop unchecked, annual losses of 40,000 to 63,000 tons might have been anticipated [*R.A.M.*, ix, p. 771]. Glasshouse tomatoes are subject to severe damage from disease, more rigorous elimination of which would, in the writer's opinion, increase the output of this crop by 15 per cent. over the 6,000 tons harvested in 1935. Similarly, adequate methods of seed treatment are available, but not yet widely enough employed, against such diseases as black leg of beet and mangold [*Phoma betae*, *Pythium de Baryanum*, *P. aphanidermatum*, and *Corticium solani*] and foot rot and pod canker of peas [*Mycosphaerella pinodes* and *Ascochyta pisi*]; in all probability the treatment of all pea seed by the wholesale merchant would contribute largely to a reduction in the losses from these sources.

WAKSMAN (S. A.). **The microbiology of cellulose decomposition and some economic problems involved.**—*Bot. Rev.*, vi, 12, pp. 637–665, 1940.

Fungi are concerned in a number of economic and industrial problems involving the decomposition of cellulose, e.g., the destruction of timber and its manufactured products, the disorganization of healthy plant tissues, and the preparation of soil and composts. The literature on these and cognate aspects of cellulose microbiology is summarized and briefly discussed in the light of recent critical studies by the author and others: much of it has already been noticed at the time of publication in this *Review*.

FAWCETT (H. S.). **Suggestions on plant virus nomenclature as exemplified by names for Citrus viruses.**—*Science*, N.S., xcii, 2398, pp. 559–561, 1940.

Proposals are submitted for plant virus nomenclature according to a system combining the best features of those of Johnson, Smith, and

Holmes without their numerical and generic complications [cf. *R.A.M.*, xx, p. 85]. The principle involved in the formation of a generic name consists in the addition of the stem 'vir' for virus (Latin neuter) to the Latin genitive of the host genus in which the virus was first detected and recognized, dropping any final consonants: to cite some illustrations, peach rosette, raspberry streak, beet curly top, and potato yellow dwarf would become, respectively, *Prunivir rosettae*, *Rubivir orientale*, *Betaevir eutetticola*, and *Solanivir vastans*. Since the virus names are predetermined by the name of the host and since they carry their own meaning authors need only be cited for the species name. New combinations would consequently be unnecessary. A further suggestion is that no suspected virus be given a binomial name merely from the observation of certain symptoms indicative of this type of infection until conclusive proof is forthcoming of its transmissibility from plant to plant by budding, grafting, insect vectors, or mechanical means. Varietal names, when applied, should follow established botanical procedure, but in no case should they be based merely on slight fluctuations in behaviour in relation to the host. Following up this line of thought the writer proposes for the citrus viruses causing infectious mottling, psorosis, psorosis A, and psorosis B [ibid., xviii, p. 100] the designations *Citrivir italicum*, *C. psorosis*, *C. psorosis* var. *vulgare*, and *C. psorosis* var. *anulatum*, respectively.

LE CLERG (E. L.). **Pathogenicity studies with isolates of Rhizoctonia solani obtained from Potato and Sugar Beet.**—*Phytopathology*, xxxi, 1, pp. 49–61, 2 figs., 1941.

None of the 89 isolates of *Rhizoctonia* [*Corticium*] *solani* from lesions on the underground stems of older potato plants or from sclerotia on the tubers in widely separated areas of the United States proved to be pathogenic to sugar beet roots [*R.A.M.*, xix, p. 59]. On the other hand, strains of the fungus from beet were, in general, more actively injurious to potatoes than were the isolates from the latter host. Of 97 isolates from spring infections of potato stolons, however, some 25 per cent. were more or less pathogenic to beets, while potato plants from a field previously occupied by severely diseased beets yielded two strains causing 83·3 and 100 per cent. decay, respectively, in inoculated sugar beet roots.

Field surveys of sugar beet and potato fields in Colorado, Wyoming, and Nebraska in 1936, 1937, and 1938 showed that sugar beets following potatoes were usually comparatively free from root rot, whereas those succeeding beets were extensively decayed. Thus, of the 50 fields in which beets were preceded by potatoes, 82 per cent. showed less than 5 per cent. infection, and 60 per cent. only a trace or more, whereas only 39 per cent. of the 28 fields of beets following beets developed 5 per cent. or less root rot. These observations are regarded as pointing to the desirability of a potato-sugar beet sequence rather than the reverse order of rotation.

MCKAY (R.). **An unusual spotting of Potato tubers and its cause.**—*J. Dep. Agric. Éire*, xxxvii, 1, pp. 93–95, 6 figs., 1940.

Numerous sunken spots, small but variable in size, were observed

on stored potato tubers of the variety British Queen. The spots occurred round the lenticels all over the tuber or only on one side, and penetrated into the flesh to a depth of 1 to 4 mm. No parasitic organism was associated with this spotting, but it was experimentally shown, on British Queen, Duke of York, and Up-to-Date potatoes, to be due to the action of rat excrement, mainly the urine. Usually, two or three applications of a mixture of rat urine and faeces given at intervals of 48 hours were required for the production of symptoms which generally appeared six or seven days after the first application. That the damage was caused by the liquid, rather than by gases from decomposing excrement, was shown by suspending dry tubers over the mixture in a closed vessel, in which case no lesions developed.

In the course of these experiments a small number of tubers developed spotting indistinguishable from pit rot described by G. H. Pethybridge (*J. Dep. Agric. Ire.*, xix, pp. 271–292, 1918–9), and it is suggested that pit rot may be due to the absorption by the tubers of some toxic liquid in the pit.

STARR (G. H.). **Experimental work for the control of ring rot of Potatoes.** —*Amer. Potato J.*, xvii, 12, pp. 318–322, 1940.

A tabulated account is given of the experiments carried out at the Wyoming Agricultural Experiment Station on various aspects of the control of potato ring rot [*Bacterium sepedonicum*: *R.A.M.*, xx, p. 32]. Of a number of five-second dips tested for the disinfection of the cutting knife, mercuric chloride (1 in 500) proved to be the most effective, almost completely preventing the spread of infection from diseased to sound tuber halves by this means. Mercurnol, a commercial acid mercury preparation came next in order of efficacy, reducing the incidence of ring rot from 97·7 to 5 per cent. Little difference was noted between the amount of infection in lots planted soon after cutting on 1st June and in those allowed to heal over for two days.

In a test on the effect of treating infected Bliss Triumph seed before and after cutting, mercurnol (ten minutes) gave the highest yield and also the best control of ring rot (a reduction of infection from 82·4 to 35·8 per cent.) when applied before cutting.

When 85 whole tubers and the same number of cut seed pieces from an infected lot were planted, the former produced 23 per cent. diseased plants and the latter 72 per cent.

From 115 apparently healthy tubers, slightly over 30 per cent. infected plants developed, the corresponding incidence among the stand produced by 67 tubers showing mild symptoms being 85 per cent.

A cutting knife was drawn through a badly infected tuber and then used to cut ten healthy ones, one half of each of which was planted immediately and the other left to heal over for two days, the procedure being repeated five times with 10-tuber lots. Infection developed from nearly all the tubers, being as prevalent in the hill from the tenth tuber as in any of the others.

The inoculation of ten tubers on the sound skin between two eyes failed to induce the disease in the resulting plants, suggesting that the eyes may serve as channels of invasion for the bacterium.

WAKSMAN (S. A.). **Antagonistic interrelationships among micro-organisms.**—*Chron. bot.*, vi, 7, pp. 145–148, 1940.

In this paper (based on an address delivered to the New Jersey Section of the American Chemical Society on 18th November, 1940) the author succinctly reviews and discusses the history of investigations into antagonism among spore- and non-spore-forming bacteria, Actinomycetes, and fungi, with special reference to the control of disease.

WAKSMAN (S. A.) & WOODRUFF (H. B.). **Survival of bacteria added to soil and the resultant modification of soil population.**—*Soil Sci.*, l, 6, pp. 421–427, 1940.

In further experiments at the New Jersey Agricultural Experiment Station on the survival of micro-organisms introduced into the soil [*R.A.M.*, xix, p. 431], fungi proved resistant to the action of (*a*) filtrates of two soil bacteria antagonistic to *Aerobacter aerogenes* and other introduced bacteria, and (*b*) a purified active substance, exerting bacteriostatic effects, isolated from a soil *Actinomyces* and designated actinomycin.

CHESTERS (C. G. C.) **A method of isolating soil fungi.**—*Trans. Brit. mycol. Soc.*, xxiv, 3–4, pp. 352–355, 1 diag., 1940 [issued 1941].

Details are given of a method for the isolation of soil fungi by means of immersion tubes filled with sterile agar or solid plant tissue, thereby obtaining the organisms under the actual conditions of moisture and temperature prevailing *in situ*. Experiments are in progress with three types of tubes viz., direct contact, capillary type, and a special pattern devised for the isolation of Phycomycetes. The tubes have varying numbers of small holes (according to the purpose for which they are designed), either flush with the wall or extending inwards as capillaries; they are sterilized in an autoclave and filled, while enclosed in a container tube, with almost cool nutrient agar to just above the highest capillary, pushed into the soil to the required depth, left to incubate for seven to ten days, and then removed to the laboratory in fresh sterile containers for the subculturing of the colonies developing opposite the capillaries.

CHRISTENBERRY (G. A.). **A taxonomic study of the Mucorales in the Southeastern United States.**—*J. Elisha Mitchell sci. Soc.*, lvi, 2, pp. 333–366, 19 pl., 1940.

Most of the 403 collections of soil and dung on which the present study is based were made in North Carolina, but a few specimens from South Carolina, West Virginia, and four other States were included. Fifty-three species belonging to 18 genera were identified in pure culture on Blakeslee's No. 230 agar, 16, including two new [unnamed] species of *Mucor* (Nos. 1 and 2) being new to the United States. A new variety, *albus* [without a Latin diagnosis], of *Zygorrhynchus vuillemini* [*R.A.M.*, xviii, p. 137] was isolated from pine straw. Keys are supplied for the identification of genera and species.

EDGERTON (C. W.) & FORBES (I. L.). **Hot water treatment of seed Cane.**—*Sug. Bull., N.O.*, xviii, 18, pp. 4–5, 1940. [Abs. in *Facts ab. Sug.*, xxxvi, 1, p. 32, 1941.]

The best results in the control of chlorotic streak of sugar-cane at the Louisiana Agricultural Experiment Station [*R.A.M.*, xix, p. 729] by the hot water treatment of the seed pieces were obtained when the temperature was not allowed to exceed 52° C., the Co. 281 and 290 varieties being particularly subject to heat injury. Untreated cane is liable to germinate very poorly and the young shoots often fail to develop satisfactorily. On the other hand, the hot water treatment cannot be absolutely relied upon to produce better stands, its effects being apparently dependent on weather conditions during the following winter.

MCMARTIN (A.). **Eye spot and brown stripe. A report on diseased Sugarcane leaves from Sena Sugar Estates.**—*S. Afr. Sug. J.*, xxiv, 12, p. 653, 1940.

At the Mount Edgecombe Experiment Station, Natal, the writer examined specimens of sugar-cane leaves showing symptoms highly indicative of brown stripe (*Cochliobolus stenospilus*, the ascigerous stage of *Helminthosporium stenospilum*) [*R.A.M.*, xix, p. 432], the absence of 'runners' (long, pale strips, eventually turning red, at the end of the halo surrounding the stripes), the narrower halo, and the numbers of lesions with blunt instead of pointed ends suggesting this disease rather than eye spot (*H. sacchari*) [ibid., xx, p. 134], though both are present in a mild form in Natal, and the latter may have been involved. Unless the infection assumes a very severe character, a better crop may probably be cut from Co. 281 than from a variety more resistant to the disease but perhaps less satisfactory in other respects.

BULLER (A. H. R.). **The flexuous hyphae of Puccinia graminis and other Uredinales.**—Abs. in *Phytopathology*, xxxi, 1, p. 4, 1941.

Craigie's data in regard to fusion between pycnospores of opposite sex and flexuous hyphae in *Puccinia helianthi* [*R.A.M.*, xii, p. 318] were confirmed by the author, not only in the sunflower rust but also in *P. graminis* [ibid., xvii, p. 163], *P. coronata*, and *Gymnosporangium clavipes*. Flexuous hyphae have been seen by the author in 30 species of eight genera of the Uredinales. In *Puccinia*, *Uromyces*, and *Gymnosporangium* they are accompanied by many straight or slightly bent, slenderly conical, pointed periphyses, which are absent, however, from the flexuous hyphae of *Phragmidium*, *Gymnoconia*, *Cronartium*, *Melampsora*, and *Melampsorella* [ibid., xix, p. 559].

WAKEFIELD (E[LSIE] M.). **Nomina generica conservanda. Contributions from the Nomenclature Committee of the British Mycological Society. III.**—*Trans. Brit. mycol. Soc.*, xxiv, 3–4, pp. 282–293, 1940 [issued 1941].

The arguments for and against the conservation of twelve further generic names of fungi [*R.A.M.*, xix, p. 118], together with the recommendations of the Nomenclature Committee of the British Mycological Society, are presented, the genera dealt with including *Cordyceps*

(Fr.) Link; *Daldinia* Ces. & de Not. (1863) versus *Perisp(h)aeria* Rouss. (1806), *Perispherostoma* Gray (1821), and *Hemisphaeria* Klotzsch (1843); *Hypospila* Fr. (1825), *Hypospila* Karst. (1873), and *Phoma* Fr. (1823); *Teichospora* Fuckel (1869), *Strickeria* Körber (1865), and *Sphaeria* Fries (1823); *Dothidella* Speg. (1880) and *Plowrightia* Sacc. (1883); *Agaricus* Linn. ex Fr. (1821) versus *Psalliota* (Fr.) Quél. (1872), and *Pratella* (Pers.) S. F. Gray emend. Gill. (1874); *Septoria* Sacc. (1884) versus *Septoria* Fr. (1828); and *Ramularia* Sacc. (1880) versus *Ramularia* (Ung.) Corda (1842).

SAMPSON (KATHLEEN). **List of British Ustilaginales.**—*Trans. Brit. mycol. Soc.*, xxiv, 3–4, pp. 294–311, 1940 [issued 1941].

This is the second of the lists of British fungi to be completed in conformity with the recommendations of the Plant Pathology Committee of the British Mycological Society [cf. *R.A.M.*, xx, p. 35]. Plowright's monograph (1889) remains the standard work on the British Ustilaginales, few taxonomic studies on which have been carried out during the present century. The hosts cited by Massee in his 'Mildews, Rusts and Smuts' (1913), based on Plowright's work, are not all derived from British records. The 70 names included in the present list are arranged alphabetically under the three families, Ustilaginaceae, Tilletiaceae, and Graphiolaceae. The prevailing tendency as regards the classification of physiologic races in the Ustilaginales has been to accord them specific rank, a procedure tending to aid diagnosis up to a point; however, the results of more intensive studies, so far limited to a few species, indicate that both host and pathogen comprise a complex network of biotypes, and that the limits set by the classificatory units of higher plants are not strictly followed by the fungus. The author is of opinion that the provision of each such race with a binomial and an authority merely serves to obscure genetic relationships without elucidating the species concept.

MUNDKUR (B. B.). **A second contribution towards a knowledge of Indian Ustilaginales. Fragments XXVI–L.**—*Trans. Brit. mycol. Soc.*, xxiv, 3–4, pp. 312–336, 1940 [issued 1941].

In this further contribution towards a knowledge of the Indian Ustilaginales [*R.A.M.*, xviii, p. 627], which includes six new species [with Latin diagnoses], the writer transfers *Tilletia indica* [ibid., x, p. 780] to *Neovossia* by reason of its unbranched, rather long promycelia, each with a whorl of non-fusing primary conidia (Buller's primary sterigmata), 32 to 128 $\mu$ or more, at the apex. Moreover, *N. indica* differs from *T. foetens* and *T. caries* in destroying only part of the kernels and not the whole grain, and from *T. triticina* Ranojević and *T. controversa* Kühn in spore dimensions and mode of germination.

*T. panici* n.sp. was collected in 1928 on a species of *Panicum* at Calcutta, and *Ustilago lachrymae-jobi* n.sp. on *Coix lachryma-jobi* on the Girnar Hills, Junagadh, in 1913.

Butler and Bisby's observation [ibid., xi, p. 545] that the form of *Tolyposporium penicillariae* occurring on *Pennisetum typhoides* [ibid., x, p. 625] at Poona does not conform to Brefeld's description (Untersuchungen Gesammtgebiete Mykologie, xii, pp. 99–236, 1895), is

applicable only to the smut from this particular locality, which was found to agree more closely with *T. senegalense* Speg. and is accordingly referred to this species.

*Entyloma fuscum* was collected on *Papaver rhoeas* [*R.A.M.*, xvii, p. 15] at Lahore in 1939, and *E. dahliae* [ibid., xvii, p. 294] on *Dahlia coccinea* in Bombay in 1936.

CORNER (E. H. J.). **Note: larger fungi in the tropics.**—*Trans. Brit. mycol. Soc.*, xxiv, 3–4, p. 357, 1940 [issued 1941].

Applying his Malayan observations to tropical Asia and Australasia as a whole, the author states that the larger fungi would appear to abound in these regions numerically, generically, and specifically, but their seasonal fructifications develop and rot so quickly during the first rains after a dry spell that all trace of them is apt to vanish if the forest cannot be daily visited during the critical fortnight for collection.

VALLEAU (W. D.). **A comparison of the viruses of streak of Tobacco and yellow dwarf of Potato.**—Abs. in *J. Bact.*, xl, 6, p. 869, 1940.

A comparative study at the Kentucky Agricultural Experiment Station of the host range and physical characters of the tobacco streak and potato yellow dwarf viruses [*R.A.M.*, xix, p. 724] indicates that they are similar, and possibly merely strains of one virus. Tomato and potato, previously believed to be immune, were found to be hosts of tobacco streak. Potato yellow dwarf is known to affect red clover [*Trifolium pratense*], and circumstantial evidence denotes that the streak virus is transmissible from sweet clover [*Melilotus alba*] to tobacco [ibid., xix, p. 567]. The symptoms of the two viruses are not identical either in tobacco or *Nicotiana rustica*: in the former yellow dwarf causes vein-clearing and no streak. Tobacco with systemic yellow dwarf developed a combination of symptoms on inoculation by grafting with the streak virus, but the fact that the former confers no protection against the latter does not necessarily point to a difference in identity, since the same virus may comprise both necrotic and non-necrotic strains.

PARK (M.) & FERNANDO (M.). **Recent research in Ceylon on the frog-eye disease of cigarette Tobacco.**—*Trop. Agriculturist*, xcv, 3, pp. 131–135, 1940.

This is a summary of the researches carried out at the Wariyapola and Ganewatta Experiment Stations, Ceylon, from 1936 to 1939, inclusive, on the control of tobacco frog eye (*Cercospora nicotianae*) [*R.A.M.*, xviii, p. 420; xx, p. 36], the results of which were severally noticed at the time of their publication.

HOPKINS (J. C. F.). **Field spraying of Tobacco. Reports from demonstration plots.**—*Rhod. agric. J.*, xxxviii [xxxvii], 12, pp. 702–705, 1940.

Successful control of tobacco wildfire [*Bacterium tabacum*], angular leaf spot [*Bact. angulatum*], frog eye [*Cercospora nicotianae*], and (to some extent) of *Alternaria* [*longipes*] by copper sprays having been verified by close observations over areas of 20 to 80 acres in Southern Rhodesia from 1936 to 1939, inclusive, ten demonstration plots, each

10 acres in extent, throughout the tobacco-growing areas were treated under the direction of the Department of Agriculture. The reports received from the various growers undertaking the operations were almost uniformly favourable. Reckoning 10 to 15 gals. per acre per application, three treatments of 10 acres would involve a total consumption of fungicide of 300 to 450 gals., amounting to a cost of between 18*s.* 7½*d.* and £3. 6*s.* 1*d.*, according to the preparation chosen.

DIACHUN (S.) & VALLEAU (W. D.). **Conidial production in culture by Cercospora nicotianae.**—*Phytopathology*, xxxi, 1, pp. 97–98, 1941.

Abundant conidial production by *Cercospora nicotianae*, the agent of frog eye of tobacco in Kentucky, was obtained on a medium made as follows: 600 gm. yellow and green leaves from the lower quarters of Burley plants were ground, placed in 2 l. distilled water, and steamed for one hour, 60 gm. agar dissolved in 1 l. water added, the mixture being strained through cheesecloth and a cotton pad, and then autoclaved. Inoculum from potato dextrose agar slants was stirred into the tobacco agar and the plates were incubated at 27° C. in a dark chamber. On 6th May, 1940, five days after inoculation, 26 out of 27 isolates were producing conidia, and further successful results were obtained in later experiments. The conidia formed in culture resembled in shape and size those occurring on frog eye spots in the field, but the conidiophores were longer and straighter, with more widely separated geniculations. Typical frog eye lesions developed on leaves atomized with spores from tobacco agar cultures.

WILSON (J. D.). **Spraying versus dusting of canning Tomatoes with early and delayed applications.**—*Bi-m. Bull. Ohio agric. Exp. Sta.*, xxv, 204, pp. 76–84, 1940.

Comparative tests of Bordeaux mixture (4–4–50), copper lime dust (20–80), copper compound A (Graselli Chemical Co., Cleveland, Ohio: 2¼–4–50), the same in dust form plus flour and talc (13–20–67), copper oxychloride sulphate (Harshaw Chemical Co., Cleveland: 2–4–50), the same as a dust plus flour and talc (12–20–68), copper hydro 40 (4–4–50), the same in dust form plus flour and talc (24–20–56), tribasic copper (2–4–50), the same as a dust plus flour and talc (12–20–68), cuprocide 54 (2–4–50), and cuprocide G.A. (7–20–73) for the control of tomato leaf spot (*Septoria* [*lycopersici*]) at Wooster, Ohio [*R.A.M.*, xx, p. 2] are described. The results showed dusting to be superior to spraying for this purpose when five applications were given at 10-day intervals, from 10th July to 21st August, the average yield per acre thus obtained at the first picking on 25th September being 19·8 tons as compared with 18·3, 18·2, and 17·8 for the delayed dust (from 1st to 21st August), early spray, and delayed spray schedules, respectively. No one of the copper-containing materials tested gave significantly better results than another when average yields of all four treatments were considered. The average increase of yield resulting from five treatments (spray or dust) over the controls was 3·4 tons per acre, equivalent to a net return of some $30 per acre. Compound A gave particularly good results in the delayed dusting schedule; both this preparation and Bordeaux mixture exert a retarding effect on ripening, the yield secured at the

late picking on 5th October from plots treated with compound A amounting to 4·1 tons per acre, the maximum obtained at this stage and representing an increase of 2·24 tons over the controls.

Brown (W.). **Damping-off disease of Tomatoes.**—*Gdnrs' Chron.*, Ser. 3, cix, 2824, p. 55, 1941.

The writer briefly describes the excellent results obtained at the Biological Field Station, Slough, in the control of damping-off of tomatoes (*Phytophthora* sp.) in heavily infested soil by a modification of the method of Alexander *et al.* [*R.A.M.*, xi, p. 408], consisting in the incorporation of a mixture of 15 parts formalin and 85 parts of sawdust, charcoal, or air-dried soil, at the rate of 4 to 5 parts per 1,000 of soil. In one test the emergence of the treated and control series amounted to 89 and 17 per cent., respectively.

Hill (A. V.). **Host range and distribution of Tomato big bud.**—*J. Aust. Inst. agric. Sci.*, vi, 4, pp. 199–200, 3 figs., 1940.

During the three seasons 1938 to 1940, big bud of tomato [*R.A.M.*, xix, p. 388; xx, p. 93] was observed on *Solanum nigrum* and *Datura stramonium* in several districts of New South Wales and Victoria. In addition, big bud symptoms were observed on eggplant and were similar to those obtained by grafting infected tomato scions on healthy eggplant. Big bud symptoms also occurred on non-Solanaceous plants, indicating a wide host range of the virus. Field observations suggest that an active insect, such as a jassid, is probably the vector. It is considered likely that the disease known as 'big bud' in Australia, 'stolbur' and 'montar' of tobacco, tomato, and chilli in the U.S.S.R. [ibid., xviii, p. 699], and 'little leaf' of eggplant in South India [ibid., xix, pp. 61, 259] are all due to the same virus or to very closely related viruses.

Endrinal (D. M.) & Celino (M. S.). **Septoria leaf spot of Tomato.**—*Philipp. Agric.*, xxix, 7, pp. 593–610, 3 figs., 1940.

A full description is given of the leaf spot of tomato caused by a fungus considered to be similar to, if not identical with *Septoria lycopersici*, observed for the first time in the Philippines in October, 1939. The fungus was isolated from the greyish to brownish spots, 2 to 3 mm. in diameter, and grown on a number of standard media, of which potato dextrose agar proved to be the most suitable, followed by oatmeal and tomato decoction agars. The optimum hydrogen-ion concentration for the development of the pathogen at 19° to 20° C. was found to lie between $P_H$ 5·6 and 8·4. Inoculation experiments with spore suspensions of *S. lycopersici* on five foreign [American] tomato varieties, True Giant Ponderosa, Dwarf Giant, Sunnybrook Earliana, Marglobe, and Matchless, and two native sorts, Pear and Cherry, gave positive results. Of four other Solanaceae tested for their reaction to the fungus, namely, eggplant, potato, [chilli] pepper, and tobacco, only the two first-named developed small, black foliar spots, which practically disappeared on the removal of the plants from the inoculation chamber, suggesting that in nature infection would probably not occur except under very humid conditions. A number of plants belonging to other families were inoculated without success.

The causal organism of the leaf spot was shown to penetrate the host through the stomata, and to persist from one season to the next in the form of spores and mycelium on diseased plant material. The spores may be carried on the seeds of infected plants and are also disseminated by wind and rain, while experimental evidence further denotes that infection may spread through the soil and also that adults of *Epilachna vigintioctopunctata* may be instrumental in transmitting the spores from plant to plant. The spores were found to remain viable for six months on dried infected leaves. In addition to the usual sanitary measures, the writers recommend sterilization of the seeds by one minute's immersion in mercuric chloride, followed by rinsing in sterile water before planting.

**Chestnut blight sweeps clean.**—*J. For.*, xxxviii, 12, p. 970, 1940.

Chestnut blight (*Endothia parasitica*), first observed in Bronx Park, New York City, in 1904, has spread over practically the entire eastern range of its host. According to a recent statement by G. F. Gravatt and M. E. Fowler, of the Bureau of Plant Industry, there is not a single large original tree undamaged among uncounted millions, alleged instances of survival being merely temporary escapes from infection among stump and root sprouts or seedlings, and in no way representative of true resistance. After 25 years of record-keeping, the Bureau has not found one tree that can be regarded as truly immune, but some hope for the future growth of forest chestnuts lies in the work of hybridization between American and the resistant Asiatic types [*R.A.M.*, xx, p. 140].

CARTER (J. C.). **Diseases of ornamental Oaks in Illinois.**—*Arborist's News* (*Nat. Shade Tree Conf.*), iv, 12, pp. 89–92, 2 figs., 1939. [Received November, 1940.]

Semi-popular notes are given on the diseases of ornamental oaks (including *Quercus macrocarpa*, *Q. palustris*, *Q. borealis-maxima*, *Q. coccinea*, *Q. rubra*, and *Q. alba*) in Illinois, of which anthracnose (*Gnomonia veneta*) [*R.A.M.*, xviii, p. 354] is stated to be the most prevalent and destructive on the foliage. The disease attacks chiefly *Q. alba*, producing a leaf spot and scorch followed by defoliation, which may be complete in cool, wet springs. The fungus also induces twig cankers, which may serve to carry the fungus from one season to the next. Defoliation over a number of years causes die-back of the twigs and general debility, leading to various branch diseases. Of these twig blight, most in evidence on *Q. borealis-maxima*, is associated principally with a species of *Dothiorella*, while several organisms, viz., *Dothiorella*, *Coryneum*, *Cytospora*, *Phoma*, *Nummularia*, and *Diatrype* spp., may be involved in the production of branch cankers, the two first-named being responsible in over 50 per cent. of the cases studied and also commonly involved in the causation of die-back. Smooth patch of white oak (*Aleurodiscus oakesii*) [ibid., xii, p. 601] causes a sloughing-off of the more or less extensive areas of the outer bark, producing unsightly patches without, however, retarding the growth of the tree. *Armillaria mellea* causes heavy damage in neglected plantings, but recent trials have shown that its ravages can be largely counteracted by due attention

to nutritional factors and pruning. Heart rots of various types due to *Polyporus*, *Fomes*, and *Fistulina* [*hepatica*; ibid., xx, p. 140] are stated to cause relatively little injury.

CAMPBELL (W. A.) & DAVIDSON (R. W.). **Top rot in glaze-damaged Black Cherry and Sugar Maple on the Allegheny Plateau.**—*J. For.*, xxxviii, 12, pp. 963–965, 1 fig., 1 graph, 1940.

The glaze storm of March, 1936, caused extensive damage to second-growth hardwoods in the Kane Experimental Forest and elsewhere in northern Pennsylvania and southern New York. Nineteen months after the event B. Sleeth examined a limited number of top wounds in living black cherry (*Prunus serotina*) trees (the most severely injured), and found that white decay (mainly *Polyporus* [*Polystictus*] *versicolor* and *Stereum rameale*) had progressed from 3 to 24 in. (average 14 in.) downwards below the breaks (*Tech. Note Allegheny For. Exp. Sta.* 20, 1938). In August, 1939, the writers examined 191 top wounds in 66 40- to 50-year-old black cherries, and eight months later 94 in sugar maple (*Acer saccharum*) of the same age. The downward extent of visible decay in black cherry averaged 23·5 in. for all breaks (1·5 to 5·5 in.) in diameter. *P. versicolor* and *S. rameale* were again the principal fungi isolated from 82 per cent. of the 152 black cherry samples, being responsible severally for 59 and 20 per cent. of the rot and jointly for 10 per cent., while *P. pergamenus* and unidentified organisms were implicated in 0·7 and 9 per cent., respectively, of the decayed areas. In sugar maple the decay from top breaks under 5 in. in diameter was restricted to 6 in. or less from the wound, and was concentrated chiefly in the oldest wood at the centre. Nine of the 31 wounds from which isolations were attempted yielded *P. versicolor*, 3 *Polyporus hirsutus*, 3 *Hypoxylon* sp., and 4 unidentified wood-rotting fungi.

DAVIDSON (R. W.), CAMPBELL (W. A.), & LORENZ (R. C.). **Association of Stereum murrayi with heart rot and cankers of living hardwoods.** —*Phytopathology*, xxxi, 1, pp. 82–87, 1 fig., 1941.

Isolations on a tannic acid medium [*R.A.M.*, xviii, p. 360] from decay in living yellow and paper birches (*Betula lutea* and *B. papyrifera*), the former in Wisconsin and Michigan and the latter in Minnesota, occasionally revealed the presence of *Stereum murrayi* [ibid., xvi, p. 505] in the heartwood. The fungus was further obtained from cankers on yellow birch and sugar maple (*Acer saccharum*) and from incipient rot in red maple (*A. rubrum*), while sporophores were observed in association with trunk cankers and heart rot of ironwood (*Ostrya virginiana*), beech (*Fagus grandifolia*), and striped maple (*A. pennsylvanicum*). Characteristics of the organism in pure culture included slow growth, a dense, white to cream-coloured, velvety or short cottony, adpressed, mycelium, a distinctive odour of vanilla [ibid., xix, p. 54], and a russet vinaceous to fawn coloration of the submerged agar. The optimum temperature for growth appeared to be about 25° C. and the upper limit 30°. Entry into the host is believed to be effected through dead branch stubs or basal or upper trunk injuries. The economic importance of *S. murrayi* has not yet been ascertained but it has been

occasionally isolated from merchantable yellow birch in the Lake States.

BANFIELD (W. M.). **Relation of vessel length at infection points to extent of vascular invasion in American Elm by Ceratostomella ulmi.**—Abs. in *Phytopathology*, xxxi, 1, p. 2, 1941.

In inoculation experiments with *Ceratostomella ulmi* on American elms [*Ulmus americana*], carried out one hour before felling during June, the extent of vascular invasion [*R.A.M.*, xvi, p. 505] was found to be largely conditioned by the length of the vessels at the site of injection. Vessels found in new shoots were only a few centimetres long, whereas those in the bole frequently measured several metres. Spores introduced 1 to 4 in. from the apex of new shoots had induced no pathological symptoms by the end of the season; at the end of two years the average depth of penetration by the fungus was 8·7 in. Injections in the centre of one-year leaders or in crotches formed at their apices induced widespread vascular invasion in 6 per cent. of 323 experiments, the corresponding percentage for 347 in two-year-old stems being 20. All injections through the bole resulted in extensive vascular diffusion of the fungus. Invasion was limited to several feet in trees 60 ft. high, girdled every 5 ft., injected at stump height in June, and left standing all the season.

MCKENZIE (M. A.) & JOHNSON (E. M.). **Cephalosporium Elm wilt in Massachusetts.**—*Bull. Mass. agric. Exp. Sta.* 368, 24 pp., 12 figs., 1939. [Abs. in *Exp. Sta. Rec.*, lxxxiii, 6, p. 790, 1940.]

The spores of the *Cephalosporium* stage of the fungus [*Dothiorella ulmi*] responsible for an elm wilt simulating that due to *Ceratostomella ulmi* in Massachusetts [*R.A.M.*, xx, p. 140] were found to germinate best on potato dextrose agar, in darkness, and in a moist atmosphere. Most of the information presented here has already been noticed from other sources, but it is of interest to note that the thermal death point of the pathogen lies between 75° and 80° C., and that the viability of the spores is not impaired by freezing. Inoculation experiments on wounded leaves of *Ulmus americana* and its var. *ascendens*, *U. campestris*, *U. glabra* var. *fastigiata*, *U. parvifolia*, and *U. pumila*, were successful in all cases, while infections through injured twigs were also positive on all the species except *U. glabra* var. *fastigiata*. These results denote that in nature, comparable fresh injuries by insects might easily serve as infection courts. Discrepancies between the authors' New England data and those obtained in Nebraska suggest the possible involvement of more than one strain of the fungus. Control measures should be directed towards the maintenance of vigour in the infected trees, particularly by the careful excision and burning of diseased tissues and appropriate treatment of fresh wounds or scars.

WOLF (F. A.) & BARBOUR (W. J.). **Brown-spot needle disease of Pines.**—*Phytopathology*, xxxi, 1, pp. 61–74, 3 figs., 1941.

A full description [with a revised Latin diagnosis] is given of the causal organism of the destructive brown spot needle disease of pines, especially longleaf (*Pinus palustris*) in North Carolina and elsewhere

within the host ranges, viz., *Systremma acicola* (Dearn.) comb. nov., synonyms of which include *Scirrhia acicola* (Dearn.) Siggers [*R.A.M.*, xix, p. 248], *Septoria acicola* (Thüm.) Sacc., and *Oligostroma* (*Phyllachora*) *acicola* Dearn. [ibid., vi, p. 126]. The genetic connexion between the perfect and conidial stages, the latter identified by H. Sydow and F. Petrak as *Lecanosticta acicola* (Thüm.) Sacc. (*Ann. mycol., Berl.*, xxii, pp. 398–400, 1924), was established by growth in pure culture on standard agar media.

Viable conidia may be found at any time of year, extruded from erumpent acervuli in heaps bound together by a matrix; they are adapted to distribution by splashing rain to longleaf pines in the so-called 'grass' stage (the first three to five years of life, during which the oldest dry needles cling round the stems of the seedlings, imparting to them the aspect of tussocks of dead grass, with upright spotted needles in the centre). The perithecia are initiated in stromata bearing concurrently both spermogonia and carpogonia, and take six to eight weeks to reach maturity. The ascospores are disseminated by air currents.

The brown spot pathogen being a member of the Dothideales and pigmented throughout, it appears to be most suitably accommodated in the phaeodidymous, aparaphysate genus *Systremma*, as defined by Theissen and Sydow (loc. cit., xiii, pp. 149–746). Controlled fires appear to offer the best prospects of combating the disease.

Hirt (R. R.). **Relative susceptibility to Cronartium ribicola of 5-needled Pines planted in the east.**—*J. For.*, xxxviii, 12, pp. 932–937, 1940.

Studies were conducted in 1932 and 1933 at Warrensburg, and in 1936 and 1937 at Syracuse, New York, to determine the relative susceptibility of 11 species of young five-needled pines to *Cronartium ribicola* [*R.A.M.*, xviii, p. 3]. Within each site the trees were exposed to natural infection from black currants and later grown in plantations, where they were protected from further infection by the methods recommended by the U.S. Dep. Agric. The trees were regularly examined for blister rust cankers until the end of 1938. *Pinus lambertiana*, *P. excelsa*, and *P. parviflora* died in such large numbers during the first winter after inoculation as to preclude their tabulation in the final results, though the last-named was observed to develop some infection. *P. cembra* var. *helvetica* failed to contract the disease, thereby confirming its European reputation for virtual immunity. *P. monticola* and *P. flexilis* were more susceptible than *P. strobus*, and *P. strobiformis*, *P. peuce*, *P. koraiensis*, and *P. aristata* were more resistant, the weighted average differences being calculated as + 0·45, + 0·30, 0, — 0·02, — 0·32, — 0·60, — 0·68, and — 0·71, respectively, the + or — signs indicating more or less infection, respectively, than on *P. strobus*.

Lamb (H.) & Sleeth (B.). **Distribution and suggested control measures for the Southern Pine fusiform rust.**—*Occ. Pap. sth. For. Exp. Sta.* 91, 5 pp., 1 map, 1940. [Mimeographed.]

This is a summary of the present position in regard to the distribu-

tion, host range, and control of the pine-oak rust (*Cronartium fusiforme*) [*R.A.M.*, xix, p. 173] in the Gulf and South Atlantic States of the American Union, where its elongated or spindle-shaped cankers on seedling stems and branches are characteristic and familiar to foresters, especially on slash and loblolly pines (*Pinus caribaea* and *P. taeda*), *P. palustris* being moderately, and *P. echinata* highly, resistant. Teleutospores are produced in abundance on the water and willow oaks (*Quercus nigra* and *Q. phellos*), and in descending order of profusion on *Q. laurifolia*, *Q. marilandica*, *Q. cinerea*, *Q. rubra*, and *Q. catesbaei*, *Q. alba*, *Q. stellata*, and *Q. virginiana* bearing few or none.

The percentage of infection was found to range from under 1 to over 80 per cent., the heaviest losses usually occurring in south-east Louisiana, southern Mississippi, and southern Alabama, damage of medium extent in southern Georgia, northern Florida, and southern South Carolina, and relatively inconsiderable injury in a zone west of the Mississippi and the northern parts of the Gulf and South Atlantic States, including a large portion of Florida. Surveys made from 1937 (when the presence of the rust was first demonstrated in southern pine nurseries) to 1939 revealed serious losses in the zone of maximum infection, amounting to between 15 and 35 per cent. in *P. taeda* nursery stock and up to 15 per cent. even in the semi-resistant *P. palustris*. Seedlings contracting infection by *C. fusiforme* in the nursery may be regarded as a total loss, and the same generally applies to saplings, especially of *P. caribaea*, whereas older trees may survive the attack for a number of years.

Suggested control measures include the eradication of oaks from the vicinity of pine nurseries (an oak-free zone 1,500 ft. wide apparently reduced infection at one nursery); late sowing; spraying from the time of the removal of the cover from the seed-beds until 1st June, bi-weekly for the first three weeks and then weekly, with 4–4–50 Bordeaux mixture plus liquid santomerse (1 pint per 100 gals.) or a linseed oil-soap emulsion (6 lb. raw linseed oil and 6 lb. fish oil in 6 pints water per 100 gals.) as a spreader and sticker, using high-power pressure sprayers if available; pruning away all branches with cankers less than 2 ft. from the stem; and the exclusion of infected seedlings from consignments destined for regions in which the rust is at present of little or no importance.

Acree (Ruby J.). **Temperature as a precision factor in chemically distinguishing Cronartium ribicola and C. occidentale.**—Abs. in *Phytopathology*, xxxi, 1, p. 1, 1941.

A microchemical colorimetric $P_H$ technique for the differentiation of *Cronartium ribicola* and *C. occidentale* [*R.A.M.*, xviii, p. 73] has been in constant use since 1937 in the identification of these two pine rusts in connexion with the California eradication programme, for the most part with excellent results. After eliminating all other sources of error in an attempt to account for the anomalous results obtained in October, 1938, and July, 1940, when the working conditions provided temperatures of 60° F., and in the 'upper nineties', respectively, changes to the 'seventies' afforded the necessary means of discrimination. Further

tests showed that temperatures below 70° and above 90° were unsatisfactory for the purpose in view. The success of the procedure being probably dependent on a difference in the permeability of the teleutosori of the two species, involving $P_H$ activity under the control of temperature, it is not to be expected that an unduly wide temperature range would serve the object of the studies.

HELPHENSTINE (R. K.). **Quantity of wood treated and preservatives used in the United States in 1939.**—*Proc. Amer. Wood Pres. Ass.*, xxxvi, pp. 422–447, 11 graphs, 1 map, 1940.

During 1939, 221 wood-preserving plants were in active operation in the United States, the same number as in 1938. Of these, 153 were pressure plants, 520 open-tank, while 16 were equipped with facilities for both methods of treatment. During the year a total of 245,219,878 cu. ft. of wood was treated, representing an increase of 998,436 cu. ft. (0·41 per cent.) over the previous year's figures. The consumption of creosote amounted to 163,864,259 gals., a decline of 2,319,632 gals. or 1·4 per cent. as compared with 1938. Reductions were also registered in the consumption of creosote-petroleum mixtures (9·03 per cent.) and pure zinc chloride (35 per cent.), whereas chromated zinc chloride, Wolman salts, and zinc-meta-arsenite showed increases of 751,452 lb. (41 per cent.), 330,036 lb., and 20,827 lb., respectively, over the previous year.

HUDSON (M. S.) & BAECHLER (R. H.). **The oxidation of creosote—its significance in timber treating operations.**—*Proc. Amer. Wood Pres. Ass.*, xxxvi, pp. 74–111, 2 figs., 25 graphs, 1940.

Among the conclusions drawn from this intensive study at the Forest Products Laboratory, Madison, Wisconsin, on the effects of the oxidation of creosote on its wood-preservative properties are the following. Oxidation is largely responsible for the physical changes undergone by creosote during pressure treatments, the wide differences in the reaction to the process of the various samples tested being apparently related to their tar acid content. Thus, creosotes of low specific gravity and high tar acid content, such as are produced by low-temperature carbonization, suffered decrease of toxicity towards the wood-destroying fungus Madison 517 [? *Polyporus tulipiferus*: *R.A.M.*, xvii, p. 5], the minimum lethal concentrations before oxidation of two such samples (vertical retort and lignite tars with original tar acid contents of 16·4 and 44·6 per cent.) being, respectively, 0·07 and 0·08 per cent., and after oxidation 0·12 and 2 per cent. On the other hand, creosotes with a very low tar acid content tend to acquire a slight increase of fungicidal activity as a result of oxidation.

STARKER (T. J.). **Preservative treatment of fence posts: 1939 progress report on the post farm.**—*Bull. Ser. Ore. Engng Exp. Sta.* 9a, 3 pp., 1 fig., 1940.

Further particulars are given of the condition of various series of fence posts treated by different preservative methods at the annual inspection of the Oregon State College, School of Forestry 'post farm'

in October, 1939 [*R.A.M.*, xix, p. 631]. Notes are also given on the treatments applied to a further ten series laid down in 1938–9.

NETTLES (W. C.). **A new method of impregnating green fence posts: a preliminary report.**—*J. econ. Ent.*, xxxii, 5, pp. 703–704, 1939.

Satisfactory results have been obtained at Clemson College, South Carolina, in the preservation against insect and fungal damage of green loblolly, short leaf, or slash pine [*Pinus taeda*, *P. echinata*, and *P. caribaea*] by the following method. The posts are cut into 6 ft. lengths and the top end immediately immersed for three hours in a trough or half of a wooden barrel containing a solution of copper sulphate sufficient for the absorption of $\frac{3}{4}$ lb. of the chemical per cu. ft. of wood; a 1 in. disk is sawn off the basal end to remove resinous material and this end placed in the solution for 24 to 48 hours, after which the post is taken out, the ends again reversed, and stood up for two to four weeks, or until thoroughly seasoned. In order to treat four posts 6 in. in diameter, 14 pints of solution would be required, the corresponding amounts for four of 5 in. in diameter, two of 4 in., and two of 3 in. being 10, 3·5, and 2 pints, respectively, and the approximate cost of 1, 1·75, 2·5, and 3·5 pints (the quantities necessary for the treatment of 0·29, 0·52, 0·81, and 1·10 cu. ft. wood, respectively), 2, 3·5, 5, and 7 cents, respectively.

FREITAG (J. H.). **A comparison of the transmission of four Cucurbit viruses by Cucumber beetles and by aphids.**—Abs. in *Phytopathology*, xxxi, 1, p. 8, 1941.

The most efficient insect vectors of four cucurbit viruses occurring naturally in California were experimentally determined. Squash [or vegetable marrow] mosaic was readily transmitted by the western striped and twelve-spotted cucumber beetles (*Diabrotica trivittata* and *D. soror*), but infrequently by aphids; *D. trivittata* infected 23 out of 25 plants and *D. soror* 8 out of 25, while of eight species of aphids tested, five conveyed the virus from diseased to healthy plants in only 13 cases out of 245. Cucurbit ring mosaic was transmitted by both beetles and wild cucumber (*Echinocystis fabacea*) mosaic by *D. soror*, but neither by aphids, which were the most efficient vectors of western cucumber mosaic.

WHITEHEAD (T.). **A summary of seven years' work on varieties of Swede.**—*Welsh J. Agric.*, xvi, pp. 99–110, 1940.

A tabulated account is given of the writer's trials at Aberystwyth, from 1933 to 1940, of a number of popular swede varieties for their reaction to different factors of agricultural importance, including the following diseases: club root (*Plasmodiophora brassicae*), crown and root rots (*Bacillus carotovorus*) [*Erwinia carotovora*], dry rot (*Phoma lingam*), brown heart (boron deficiency), mildew (*Erysiphe polygoni*) [*R.A.M.*, xiv, p. 807], and from 1938 to 1940, physiological splitting of the roots. Garton's White Fleshed showed average resistance to most diseases, except dry rot, by which it was much less affected than

most of the other varieties. Majestic was resistant only to the crown rot phase of *Erwinia carotovora* and to physiological splitting of the root. Wilhelmsburger, on the other hand, proved resistant to *E. carotovora* in the roots but succumbed to infection by the same organism in the crown; it was also susceptible to physiological split and brown heart, but more resistant to club root than any of the other varieties tested, and therefore safe for use on contaminated land. Magnificent was uniformly susceptible to the diseases under observation, but showed some resistance to physiological split, while Improved Lord Derby was resistant (in a moderage degree) only to mildew. Magnum Bonum was fairly resistant to club root, crown rot, and root rot, but was susceptible to all other diseases, especially to mildew. Superlative showed marked resistance to brown heart, mildew, and physiological splitting of the root and average resistance to the other diseases, except dry rot, to which it is definitely susceptible. Conqueror was severely attacked by club root and brown heart, but showed moderate resistance to the other diseases. Up-to-Date was resistant only to *E. carotovora*, especially in the roots, and to physiological splitting, while Purdy's was susceptible to all the diseases except club root. Tipperary showed definite resistance to crown rot, but was susceptible to bacterial invasion of the roots and moderately resistant to the other diseases included in the tests. Definite susceptibility to club root and crown rot was shown by Caledonian, while Model was below the average in disease resistance, except to brown heart. Studsgaard Bangholm is comparable to Wilhelmsburger in its resistance to *Plasmodiophora brassicae*, and was further found to be definitely resistant to root rot and moderately so to crown rot and brown heart. Kinaldie's only recommendation is a tendency towards resistance to mildew.

DENNIS (R. W. G.). **Rhizoctonia rot of Swedes.**—*Nature, Lond.*, cxlvii, 3716, p. 87, 1941.

Magnificent and Tipperary purple-topped swedes growing at East Craigs, Corstorphine, Edinburgh, showed slightly sunken, putty-coloured lesions generally bearing closely spaced, faint zone lines, and a shallow, dry, fibrous, yellowish-brown rot. The condition was distinguished from that due to *Phoma lingam* by the absence of fructifications and the presence of a pink margin. All the lesions were associated with mechanical injury to the root. The putty-coloured, pink-bordered lesions were confined to the purple upper part of the root, shallow, blackish-brown, roughly circular lesions occurring on the part under the soil. Isolations from diseased tissues (above and below ground) consistently yielded a strain of *Rhizoctonia* [*Corticium*] *solani* indistinguishable in culture from those obtained from sclerotia on potato tubers [cf. *R.A.M.*, iv, p. 443; viii, p. 477; xii, p. 262].

Inoculations on mature Tipperary swede roots with strains of *C. solani* from (*a*) affected swedes, (*b*) sclerotia on the surface of a Di Vernon potato tuber, and (*c*) dead tissue below a bruise on a Golden Wonder potato tuber were made in the laboratory. Strain (*a*) inserted into cuts produced rots identical with those noted in the field, but portions of a culture of this strain placed on uninjured root surfaces had no effect.

Strains (*b*) and (*c*) caused slight browning of the edges of wounds, but produced no rotting during six weeks.

The disease was severe in the field on about 1 per cent. of the Tipperary roots. This appears to be the first record of this fungus causing rot of swedes under field conditions in Great Britain.

Newhall (A. G.). **Host range and overwintering of the Lettuce, shot-hole or anthracnose fungus, Marssonina panattoniana.**—Abs. in *Phytopathology*, xxxi, 1, p. 17, 1941.

*Marssonina panattoniana*, the agent of anthracnose, shot hole, or ring spot of leaf and head lettuce, occurs sporadically in market-gardens in New York State [*R.A.M.*, ix, p. 224] on early spring and late autumn outdoor plantings, whence it finds its way into green-houses. Inoculations with spore suspensions of the fungus resulted in the successful transference of the disease from cultivated lettuce to the native species *Lactuca scariola* and its var. *integrata*, *L. spicata*, and *L. canadensis*, while the following, supplied by R. C. Thompson, also contracted infection in the seedling stage: *L. altaica*, *L. laciniata*, *L. saligna*, *L. virosa*, *L. indica*, *L. graminifolia*, and *L. muralis*. Soil from below diseased plants was found to harbour the fungus for three, but not for six months. Infected plants of *L. scariola* and its var. *integrata* have been found growing wild in two New York counties, and lettuce seedlings were infected with inoculum from this source, indicating that the pathogen probably overwinters on the wild species in question and possibly on others.

Newhall (A. G.). **An undescribed storage rot of Celery.**—Abs. in *Phytopathology*, xxxi, 1, p. 17, 1941.

A serious storage rot of late celery, for which the name 'greenish-black rot' is suggested, causing losses in five counties in western New York, has been traced to a fungus described by [Johanna] Westerdijk in 1924 as *Cercospora cari*, the agent of caraway anthracnose [*R.A.M.*, xviii, p. 154]. Infection appears to originate in the soil, although the first symptoms rarely develop until after eight or nine weeks in cold storage, when a soft rot progresses rapidly upwards on the butt ends. None of the twelve varieties tested on infested muck soil proved markedly resistant, though Easy Bleaching, Utah, and Columbia suffered somewhat less than Giant Pascal, Golden Plume, and Meische's Improved Golden. The pathogen is characterized by a coarse, deeply coloured, torulose mycelium and sparse hyaline to subhyaline, falcate conidia, the appendage on the basal cells of which properly excludes the fungus from the genus *Cercospora*. Growth in culture takes place between 0° and 27° C., with the optimum close to 15°, and between $P_H$ 3·35 and 7·32 with the optimum near 5·3. Organic mercurial compounds, the use of which is regarded as unsafe, were the only effective preparations among ten fungicides tested for the control of the rot.

Shoemaker (J. S.). **Celery in Alberta.**—*Bull. Univ. Alberta* 35, 52 pp., 13 figs., 1940.

The following items of phytopathological interest occur in this

bulletin. Cracked stem of celery [*R.A.M.*, xvi, p. 792], due to lack of boron, may be controlled by applications of borax the following year at the rate of 10 lb. per acre near the base of the plants about a fortnight after they are set out, either dry and mixed with sand to give bulk, or in the form of a stream spray.

Unbalanced water relations are a significant factor in the development of blackheart [ibid., xiv, p. 343], injury from which is further increased by any check to growth and high temperature. The centre or heart leaves turn blackish, and the tips of the older ones assume a brownish-black tinge and shrivel up. The most effective control measure is the maintenance of conditions providing for a steady growth of the plants, keeping the soil moist but not waterlogged, and cutting the crop as soon as it reaches maturity before the hot weather sets in.

The most prevalent diseases of the crop in Alberta are late blight [*Septoria apii graveolentis*: ibid., xv, p. 553; xviii, p. 780], bacterial blight [*Erwinia carotovora*: ibid., xiv, p. 142; xvii, p. 722], chlorosis, *Sclerotinia* drop [*S. sclerotiorum*: ibid., xx, p. 4], and pink rot [caused by the same pathogen; ibid., xviii, p. 789]. The blights may be effectively combated by spraying with Bordeaux or Burgundy mixture or dusting with copper-lime (20–80), the latter being the method of choice in most celery-growing sections. Two to four applications in the seed-bed are a wise precaution against the later development of infection in the field, where the quantity of dust needed for the protection of the growing crop by weekly treatments ranges from 15 to 35 lb. per acre according to the age of the plants. Seed over two years old needs no treatment, but new stocks may be immersed for 25 minutes in hot water (118° to 120° F.), half an hour in formaldehyde (1 in 240), or 20 minutes in mercuric chloride [proportions not stated], preceded by 30 minutes' soaking in lukewarm water and followed by thorough rinsing in running, or several changes of fresh, water.

Rotation with non-susceptible crops and soil sterilization are suggested as possible means of controlling *S. sclerotiorum*.

The symptoms of stunt or yellows noted in some parts of the province differ from those reported elsewhere, and further studies are necessary before any definite pronouncements can be made concerning the disease.

Brown (B. A.). **Boron deficiencies in Connecticut.**—*J. Amer. Soc. Agron.*, xxxiii, 1, p. 85, 1941.

In E. R. Purvis's list (*Proc. Soil Sci. Soc. Amer.*, iv, 1939) of the crops affected by boron deficiency in 24 States, only lucerne, celery, and rutabagas were reported as suffering from this condition in Connecticut. In further experiments at the Storrs Agricultural Experiment Station, mangels manifested very pronounced boron deficiency symptoms on limed sandy loam plots to which borax was not applied. Under similar conditions, spinach, lettuce, and cabbage yielded much more heavily with than without borax, soy-beans made slightly better growth, whilst string beans [*Phaseolus vulgaris*], carrots, and tomatoes failed to respond to the treatment.

IMPERIAL MYCOLOGICAL INSTITUTE

# REVIEW
OF
# APPLIED MYCOLOGY

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MOORE (W. C.). **New and interesting plant diseases.**—*Trans. Brit. mycol. Soc.*, xxiv, 3–4, pp. 345–351, 2 pl., 1940 [issued 1941].

Continuing his observations on uncommon plant diseases in England [*R.A.M.*, xix, p. 597], the writer refers to his previous account of a new infection of apple leaves in Surrey tentatively attributed to *Phyllosticta angulata* and since reported from other south-eastern localities by Wormald, who stated *in litt.* that the colour of the lesions on inspection in August was typical of angular leaf spot, and that some of them bore the *Phyllosticta* and the *Cladosporium* (probably *C. herbarum*) found in earlier examinations. The froghopper *Cercopis sanguinea* was shown to be implicated in the etiology of an angular leaf spot of apple and pear trees in Kent [loc. cit.], and in the writer's experiments at Harpenden in early June, 1940, the introduction of a few individuals of the insect on to apple leaves on a muslin-covered branch resulted in the rapid development of typical reddish-brown, angular lesions, which on a subsequent inspection in August also bore *P. angulata* and a *Cladosporium.* It would therefore appear that the froghopper is the primary cause of the trouble, the fungi merely developing as saprophytes in the necrotic tissues.

The symptoms of the lettuce leaf spot caused by *Septoria lactucae* [ibid., xvii, p. 703] are described and the taxonomy of the pathogen discussed, this being apparently the first report of its occurrence in England, notwithstanding its wide distribution, embracing Italy, Germany, Denmark, France, Yugoslavia, the United States, the Argentine, Japan, and China. The writer has consulted Passerini's specimen No. 746 *Erb. Critt. Ital.* and concludes that the name *S. lactucae* Pass. (1878), which antedates *S. lactucae* Peck (1879), is valid. The disease was at first restricted to the outer leaves of Cos lettuce of the Little Gem variety, but infection spread later in a milder form to the foliage of Ideal (cabbage type). An examination of the Cos seed revealed the presence of pycnidia of *S. lactucae* on 4 to 5 per cent. of the material, suggesting that this was the source of infection.

*Pythium ultimum*, one of the agents of a tulip rot recently reported from a Buckinghamshire nursery [ibid., xix, p. 598], was found to be attacking *Colchicum* corms in the same place. The disease is characterized by crater-like holes, 1 to 1½ in. across, partly filled with soft, wet, rotten tissue, on the sides or top of the corm, the surrounding skin sometimes being soft, slightly sunken, and pale greyish-brown for

distances up to 1 in. On sectioning, the flesh underlying the lesions was found to be a pink- or brown-tinged greyish colour, deepening to brown, reddish-brown, or blackish on exposure to the air. In one case of slight infection the rot had evidently originated at a wound on the side of the corm and spread in the superficial tissues to produce a pale chocolate-brown band, ½ in. in width, extending from the top of the corm to the basal plate. The trouble is stated to be of annual occurrence in *C. speciosum* [var.] *album* and prevalent on *C. byzantinum*; the hybrids President Coolidge and Lilac Wonder are also susceptible, but *C. s.* var. *illyricum* appears to be highly resistant, contracting no trace of infection in inoculation experiments with pure cultures of *P. ultimum* isolated from *Colchicum* and tulip. Both strains induced watery wound rot in injured Duke of York potato tubers kept for three days in moist dishes at 22° C., and caused decay of tulip bulbs under similar conditions. *C. byzantinum* and *C. s.* var. *album* also responded positively to the inoculations, the former very slowly.

**Plant diseases. Notes contributed by the Biological Branch.**—*Agric. Gaz. N.S.W.*, li, 11, pp. 632–636, 3 figs.; 12, pp. 682–686, 3 figs., 1940; lii, 1, pp. 38–43, 4 figs., 1941.

In these notes on plant diseases in New South Wales it is stated that outbreaks of cucurbit mosaic [*R.A.M.*, xvii, p. 157; xviii, p. 726] are usually due to planting diseased seed. Affected seedlings are much dwarfed, and make slow growth. The first leaves are not, as a rule, mottled, but show a yellow discoloration round the margins, which may collapse and burn off. Aphid infestation of young cucurbits is very prevalent in spring, the insects spreading infection from diseased seedlings, as well as from numerous weeds and crop plants harbouring the cucumber mosaic virus. Affected plants grown from diseased seed seldom show conspicuous mottling, but plants contracting the disease as a result of aphid attack may develop pronounced symptoms. Partial recovery may occur as a result of masking of the symptoms by high temperatures. The control measures recommended consist in using seed from healthy plants only, sowing more seeds than are required at each hill, roguing out backward and abnormal seedlings early in the season, and practising weed control.

Some strains of chrysanthemum become affected by rust (*Puccinia chrysanthemi*) [ibid., xvii, pp. 460, 703] towards the end of the growing season, though infection seldom does much harm, and some varieties appear to be resistant. All infected leaves (including fallen ones) should be removed and burned, and the plants should be sprayed with lime-sulphur or a colloidal sulphur spray, or dusted with finely divided sulphur. After flowering, all the above-ground parts should be removed and burned.

During September, 1940, *Phyllachora pastinacae* was recorded on parsnip [ibid., x, p. 706], *Sclerotinia sclerotiorum* on carrot, and tomato spotted wilt on *Sonchus oleraceus*.

In the second paper it is stated that potato brown rot (*Bacterium solanacearum*) [ibid., xix, p. 69] is most common in the coastal areas, particularly on the North Coast. For control purposes, only disease-free tubers should be used. Crop rotation should be practised, highly susceptible crops being planted in the same land only once every three

or four years. Commercial sulphur should be added to the soil, followed by lime after a few months [ibid., xviii, p. 473].

As nearly all the important diseases of linseed and flax are seed-borne, all seed should be dusted before being sown with ceresan or agrosan at the rate of 2 oz. per bush. All seed of linseed or flax introduced into New South Wales from overseas for experimental purposes is examined for the presence of disease. Recently, three lots of seed from Abyssinia, Lithuania, and Canada were found to be infected with anthracnose (*Colletotrichum linicolum*) [*C. lini*: ibid., xix, pp. 656, 707], the Lithuanian sample also showing heavy infection by *Polyspora lini* [ibid., xviii, p. 256]. The only major disease of linseed so far recorded in New South Wales is rust (*Melampsora lini*) [ibid., xix, p. 707], to which the Punjab variety is locally very susceptible, though several commercially satisfactory and resistant varieties are shortly to be released to growers. These new varieties are reputed to be resistant to *Fusarium lini* [loc. cit.], suspected cases of which are stated to be under investigation.

Root and crown rot of carrots at Emu Plains was caused by *Sclerotium rolfsii* [ibid., xviii, p. 444], the first record of this fungus on carrots in New South Wales.

In the third paper of this series, root rot due to *Fusarium martii phaseoli* [*F. solani* var. *martii*: *R.A.M.*, xviii, p. 811] is reported to have been more prevalent than usual in New South Wales in 1939 and 1940 on French beans [*Phaseolus vulgaris*], losses of up to 95 per cent. of the crop being recorded on Stayley's Surprise variety. Rotation keeps the disease in check, and at least three years should elapse between bean crops on any particular soil. Under local conditions, the dwarf varieties Tweed Wonder, Canadian Wonder, Hawkesbury Wonder, and Brown Beauty (Premier) are fairly resistant, and may be grown without risk of serious loss. Stayley's Surprise, which is synonymous with Prince (Sutton's, England), should not be planted except in land known definitely to be free from infection. No newly introduced variety should be planted in infested soil until it has been ascertained to show satisfactory resistance.

Growers of early coastal peach varieties are warned against overlooking the effect of rust [*Puccinia pruni-spinosae*: ibid., xviii, p. 190] in indirectly shortening the economic life of the trees through premature defoliation. The spray programme recommended is Bordeaux mixture (6–4–40) or lime-sulphur (1 in 20) before blossom-bud burst, together with monthly applications of colloidal sulphur (1 or 2 lb. per 100 gals.) or wettable sulphur (4 or 5 lb. per 100 gals.). The sulphur applications should start not later than the first week in September and continue until early or mid-summer, according to the showeriness of the season. Peach varieties harvested locally before Christmas do not tolerate lime-sulphur applications after blossom-bud burst.

**Plant pathology and physiology.**—*Rep. Tex. agric. Exp. Sta., 1939*, pp. 84–95, [? 1940].

This report [cf. *R.A.M.*, xix, p. 518] contains, *inter alia*, the following items of interest. W. N. Ezekiel states that in co-operation with the late J. J. Taubenhaus sclerotia of *Phymatotrichum omnivorum* from a carrot field were placed in small vials of moist Houston soil in October,

1929, and stored. Germination fell to 12, 10, and 8 per cent. after 5, 6, and 7 years, respectively. None of the sclerotia from the last three containers, opened after 9, 9½, and 10 years, respectively, germinated.

In studies on the variation of *P. omnivorum* under field conditions a root rot-proof container was made of sulphur slabs in 1935 and a pure culture of *P. omnivorum* was inoculated into cotton plants grown inside. Cotton was planted in the container every year, and re-isolations were made periodically. Cultures obtained in this manner in 1939 agreed perfectly with the strain originally employed. One strain maintained in culture since August, 1929, has retained its original characteristics and its pathogenicity after ten years in culture.

*P. omnivorum* was recovered from 21·8 per cent. of a lot of experimentally girdled cotton plants growing at the advancing edges of root rot patches, from 9·5 per cent. of plants with the entire tops removed, and from 31·4 per cent. of the controls. The corresponding figures for two seasons together (including these) were 21·3, 14·5, and 31·8 per cent., respectively. Both topping and girdling also reduced the vigour of the fungus while it was still alive. In another experiment in a badly affected area plants girdled in July, 1938, showed in 1939 only one plant affected, and the disease failed to spread from this plant, though root rot attacked plants occupying, respectively, 12 and 13 per cent. of the area in the adjoining check plants.

When plants of different ages were inoculated with *P. omnivorum*, 71·1 per cent. of those 14 weeks old at the date of inoculation succumbed, the corresponding figures for those 10, 6, and 3 weeks old being 60·4, 42·4, and 16·6 per cent., respectively. In the final planting, made at the time of inoculation, 2·9 per cent. succumbed, while in a duplicate of this planting, in which the seedlings were exposed to infection (as a result of proximity) from the oldest plants, the figure was 2 per cent.

In greenhouse inoculations by Ezekiel and H. E. Rea higher percentages of infection of cotton by *P. omnivorum* were obtained by using 35 to 50 gm. of inoculum than by using 100 to 125 gm. With plants in Houston clay, soil moisture contents of 20 and 25 per cent. (oven-dry soil weight basis) favoured the development of root rot.

In experiments by L. M. Blank on the growth response of *P. omnivorum* to inorganic nitrogen compounds, the mean weights of fungal mats produced on a standard nutrient solution with equivalent amounts of nitrogen derived from ammonium nitrate, ammonium nitrite, and potassium nitrite were in the approximate ratio of 10:5:3.

In a three-years test, G. E. Altstatt, D. T. Killough, and J. E. Roberts found that the cotton varieties Half and Half, Coker 100, D. & P.L. 11a and 12, Dixie Triumph 14–5 St. 2, and Cook 144–68 were more susceptible to *Fusarium vasinfectum* than were Rowden 2088, Cook 307, Coker's 4 in 1, Dixie Triumph 85, Miller 610, Clevewilt 6 and 7, Toole, Sikes W. R. Staple, and Dixie Triumph 12.

A. L. Harrison states that in two separate experiments tomatoes were only slightly injured by applications of cuprocide 54 (1¾ lb. to 50 gals.), malachite green (¼ lb. to 50 gals.), ZO (¾ lb. to 50 gals.), and various other preparations, whereas Bordeaux mixture (4–4–50) with or without the addition of cottonseed oil caused marked reduction in the number and weight of fruits produced.

When young Marglobe tomato plants were inoculated with *F.* [*bulbigenum* var.] *lycopersici* under various conditions in the greenhouse during August or September by dipping the roots in nutrient cultures of the fungus and setting the plants in trays or cold frames [ibid., xix, p. 309], the period of immersion (varying from instant dip to 16 minutes) had no significant effect on the results. Cultures incubated from 3 to 8 days at room temperature were more virulent than older ones. Virulence was only slightly reduced by filtering through cheesecloth to remove the mycelium. Wilt appeared on inoculated plants in Lufkin fine sandy loam adjusted to $P_H$ values from 9·3 to 3·5, and became progressively more severe from $P_H$ 7 to $P_H$ 3·5. Least wilt developed at $P_H$ 9·3 [ibid., xx, p. 150]. Both inoculated plants and controls succumbed in soil adjusted to $P_H$ 2·9. Infection was more severe in inoculated plants in wet Lufkin fine sandy loam (56 per cent. of water-holding capacity) than in dry (14 per cent.) while in moist soil (29 per cent.) it was intermediate. Different isolates showed different degrees of pathogenicity.

Field and laboratory tests for resistance to wilt with over 250 tomato varieties, strains, and selections showed that of those tested the varieties most resistant to infection and at the same time best adapted to the Yoakum-Hallettsville area are Marglobe, Rutgers, Glovel, Grothen's Globe, and Pritchard [ibid., xix, pp. 170, 501].

G. E. Altstatt states that strains of *Sclerotium rolfsii* from watermelon, groundnut, sugar beet, and garlic produced the perfect stage. This was a hymenium bearing basidia, sterigmata, and spores, the last-named measuring 3·9 to 5·4 by 1·8 to 3·6 $\mu$.

In the section dealing with rice diseases (pp. 170–172), A. L. Martin and C. E. Minarik state that under greenhouse conditions rice grown in soil to which sodium nitrate was applied at the rate of 240 lb. per acre, with sulphate of ammonia at 250 and 500 lb. per acre, developed typical symptoms of 'straighthead' [ibid., i, p. 83; xvi, p. 834; xix, p. 301]. Such high concentrations of nitrogenous fertilizer are, however, not likely to be found under ordinary conditions.

Dowson (W. J.). **On the systematics of Gram negative bacterial plant pathogens.**—*Chron. bot.*, vi, 9, pp. 198–199, 1941.

In this paper the author briefly sums up and clarifies the conclusions reached in his earlier contribution to the subject [*R.A.M.*, xviii, p. 658]. He points out that the division of *Pseudomonas* (Migula) Lehmann & Neumann into *Pseudomonas* and *Xanthomonas* and the selection of *X. hyacinthi* as the type species for the new genus strictly accord with the International Rules. The Gram-positive plant pathogens, e.g., *Bacterium mangiferae*, *Bact. fascians*, *Bact. flaccumfaciens*, etc., require separate treatment, as the Gram reaction appears to denote a fundamental difference in the proteins of the Gram-positive and Gram-negative bacteria, and probably indicates an absence of any close relationship.

Pugsley (A. T.). **Transmutation of bacterial plant pathogens.**—*J. Aust. Inst. agric. Sci.*, vi, 4, pp. 195–197, 1940.

The author discusses the transmutation occurring in certain bacteria

when the colonies on agar change their normal smooth type of growth to one with a rough surface, and gives a survey of work done on this subject, citing specifically the case of *Pseudomonas fluorescens* and *Phytomonas tabaci* [*Bacterium tabacum*: *R.A.M.*, xx, p. 104].

BRAUN (A. C.). **Development of secondary tumors and tumor strands in the crown gall of Sunflowers.**—*Phytopathology*, xxxi, 2, pp. 135–149, 7 figs., 1941.

Secondary tumours and tumour strands [*R.A.M.*, v, p. 23; xiv, p. 365] were experimentally induced at the Rockefeller Institute for Medical Research, Princeton, New Jersey, by the inoculation of Giant Russian sunflowers with Riker's A6 strain of *Phytomonas* [*Bacterium*] *tumefaciens* [ibid., iii, p. 386] at a distance of 4 to 6 in. from the apical bud into almost or quite fully elongated internodes. This is considered to prove that these structures are truly secondary, not being dependent for their development on the rapid elongation of immature tissue. The ridge-like overgrowths sometimes observed extending from the primary tumour to within a short distance of the soil line are also secondary.

Tumour strands and secondary tumours were invariably found in association with the xylem region. E. F. Smith's analogy of the secondary crown gall tumours with the permeation metastases of human cancers (*Science*, N.S., xliii, pp. 871–889, 1915; *J. Cancer Res.*, i, pp. 231–309, 1916, *et passim*) would seem to be invalidated by the observation that the tumour strand does not push downwards from the primary tumour in a root-like manner, but originates in the xylem region of the vascular bundle and thence expands laterally into the pith.

Two distinct types of secondary tumours are described, one occurring in the petioles and apparently similar to those previously reported by Smith *et al.* on the Paris daisy (*Chrysanthemum frutescens*), and another developing at the first and second nodes above the primary tumour, the latter type being of particular interest by reason of their internal structure. They were characterized by a marked increase in secondary xylem, as well as by a sharply defined, though somewhat enlarged cortex, thereby differing from both the primary and the first type of secondary tumour. The above-mentioned narrow, slightly raised ridges connecting the primary tumour with a point slightly above soil-level in two out of the several hundred experimental plants were found to consist largely of secondary xylem, thus closely resembling the second type of tumour.

It has been shown that secondary tumours and tumour strands may be produced by an attenuated strain of *Bact. tumefaciens* in the absence of a primary neoplasm, suggesting that the mechanism involved in the development of the primary and secondary structures may not be identical.

MILLIKAN (C. R.). **Variation in Helminthosporium sativum induced by zinc sulphate.**—*J. Aust. Inst. agric. Sci.*, vi, 4, pp. 203–205, 3 figs., 1940.

In a study conducted in Victoria the formation of sectors was observed to occur frequently in *Fusarium culmorum* and *Helminthosporium sativum* [cf. *R.A.M.*, xviii, p. 97] cultured on glucose agar

containing 0·1 to 0·5 per cent. zinc sulphate. In the case of *H. sativum* microscopic examination showed that whereas the hyphae of the parent colonies were very distorted and thickened, those of the sector were apparently normal, indicating a much greater tolerance for zinc in the latter. No sporulation was observed in either. After transfer to potato dextrose agar containing no added zinc, the relative growth rates were completely reversed, the parent colonies growing considerably faster than the sectors, while sporulation occurred in all colonies. These relative differences in growth between the parent and sector colonies still existed after six successive transfers to fresh potato dextrose agar. It is concluded from these observations that zinc had induced a stable variant in the original culture.

RODENHISER (H. A.) & MAXWELL (L. R.). **Effect of X-radiation on the germination of chlamydospores of Ustilago hordei.**—*Phytopathology*, xxxi, 2, pp. 175–181, 1 fig., 1 graph, 1941.

The germination percentage of the chlamydospores of *Ustilago hordei* from Trebi barley was shown not to be materially impaired by exposure to X-rays in dosages up to 100 kiloroentgen (kr.), upwards of which the number of non-viable spores and the time required for the germination of the viable increased irregularly up to total destruction at 1,000 kr. Increased elongation of the promycelia resulted from the irradiation of the chlamydospores at certain dosages, becoming noticeable at 30 kr. and progressively more conspicuous at 60, 100, and 150 kr., the length at the last-named figure being some three times the normal. At 200 kr. and above, the promycelial length ranged from half to three times the normal, while at still higher dosages the tendency to elongation decreased until at 500 kr. none exceeding the average was observed. A normal number of primary sporidia developed on promycelia from chlamydospores irradiated up to 60 kr., but at 100 only 10 per cent. of the promycelia bore these organs, while at and above 150 kr. only an occasional one appeared.

The normal growth processes of the smut were found to be inhibited by lower X-ray dosages than those requisite to destroy the mechanism responsible for germination. For instance, although up to 80 per cent. of the chlamydospores germinated after irradiation at 300 kr., development ceased with the elongation of the mycelium. The term 'delayed killing' is suggested for this effect.

The rate of mutation in cultures of monosporidial lines of *U. hordei* was not affected by X-irradiation of the chlamydospores at 50 and 100 kr.

JOHNSON (T.). **Longevity of teliospores of Puccinia graminis under laboratory conditions.**—*Phytopathology*, xxxi, 2, pp. 197–198, 1941.

In laboratory experiments at the Dominion Laboratory of Plant Pathology, Winnipeg, periods of storage ranging from two to three years, preceded by freezing for up to 12 months, did not appear to impair the germinability of the teleutospores of various races of *Puccinia graminis tritici* and *P. g. avenae*, while the pathogenicity of their sporidia to barberry was also maintained. *P. g. secalis* from rye withstood 2½ years' freezing without loss of these properties. The longest storage periods (6 years 2½ months and 4 years 4 months, for

*P. g. tritici* race 9 and *P. g. avenae* race 3, respectively), did not appreciably reduce germinability but induced a weakening of virulence towards barberry.

VAN DER PLANK (J. E.) & VAN NIEKERK (O. T.). **Bleaching of sooty blotch from Oranges.**—*Fmg S. Afr.*, xvi, 178, pp. 27–28, 1941.

All bleaching solutions currently used in South Africa for the control of sooty blotch [*Gloeodes pomigena*: *R.A.M.*, xx, p. 58] of oranges are stated to be based on bleaching powder, ordinary brands of which contain 30 to 33 per cent. available chlorine. Recent trials have now demonstrated the superiority of a commercial brand of calcium hypochlorite sold under the name of H.T.H., which contains about 70 per cent. available chlorine. Other brands on the market would also probably be useful. H.T.H. contains far less calcium hydroxide than does bleaching powder, and therefore requires less boric acid or sodium bicarbonate to neutralize it, thus effecting a considerable saving in bulk and cost. About 100 lb. of H.T.H. and 20 lb. sodium bicarbonate make a bleach as active as 200 lb. ordinary bleaching powder and 150 lb. sodium bicarbonate, the costs of materials for the two treatments being £2. 12*s*. 1*d*. and £3. 14*s*. 0*d*., respectively. The former solution is also more easily prepared.

A way of saving sodium bicarbonate when using bleaching powder, is to mix the latter well with water at the rate of 4 oz. or more per gal. and to discard all undissolved residue, which is mostly calcium hydroxide, before adding sodium bicarbonate. The ordinary phenolphthalein indicator for determining acidity in juices may be used to show whether sufficient sodium bicarbonate has been added. When using bleaches as disinfectants against mould spores on the surface of the fruit, more success is achieved by making them up with boric acid instead of sodium bicarbonate. When the latter is used, however, better disinfection may be obtained with higher strengths of chlorine, if soda ash is added in order to stabilize the solution.

WAGER (V. A.). **Leaf markings for diagnosing psorosis or scaly-bark in Citrus.**—*Fmg S. Afr.*, xvi, 178, pp. 29–30, 1 fig., 1941.

Citrus trees suffering from psorosis [*R.A.M.*, xix, p. 86] in the White River and Rustenburg districts of the Transvaal exhibited typical leaf symptoms [ibid., xviii, p. 100], which were also present on a large number of trees that showed no bark symptoms. The importance of leaf symptoms for the diagnosis of psorosis is emphasized. It is suggested that the South African citrus industry should adopt the recent Californian scheme, whereby nurserymen are enabled to obtain budwood from trees officially registered as free from disease.

BAIN (F. M.). **Report on the Coconut growing areas of Jamaica.**—*Bull. Dep. Sci. Agric. Jamaica*, N.S., 22, 12 pp., 1 diag., 1940.

During 1940, the author visited Jamaica to make an investigation into the causes of the death of coco-nut palms in the western end of the island from a condition termed locally 'western-end bud rot' to distinguish it from true bud rot (*Phytophthora palmivora*) [*R.A.M.*,

xvi, p. 300], which is common on the eastern side. The available evidence (symptoms, and soil and climatic conditions) indicated that the condition was identical with bronze leaf wilt [ibid., xx, p. 111]. In discussing the relations between soil conditions and the disease, the author mentions the three main soil types on which bronze leaf wilt occurs and states that to ensure healthy growth for many years without the application of soil improvement methods, a soil depth sufficient to allow good root penetration to 4 ft. and an average rainfall of 60 to 70 in. are necessary. In Jamaica, the coco-nut-growing area in which the rainfall and soil conditions approximate to those necessary for the occurrence of the disease extends from St. Ann's Bay to Haughton Court; elsewhere, soil conditions of class (1) type [loc. cit.] would have to be present before the disease could occur. Soil of class (1) type occurs at Haughton Court, Point, Blue Hole, Mosquito Cove, Tryall, Bengal, and in small areas elsewhere. Soil of class 2 (*a*) is present at Bengal and Point, in the very low rainfall zone. Soil of class 2 (*b*) is found at Haughton Court, while one area at Flint River has class (3) soil. Details are given of the remedial measures applicable to these different soil types.

Other coco-nut palm diseases observed in Jamaica include bitten leaf (*Thielaviopsis* sp. [*Ceratostomella ? paradoxa*]) [or *P. palmivora*: ibid., xx, p. 112], bleeding stem [loc. cit.], usually due to 'shot hole borer' infestation of injuries made by machettes, leaf blight (generally caused by lack of drainage), and St. Mary's disease, a condition apparently resulting from mechanical strain on the affected whorl of leaves.

WEINDLING (R.), MILLER (P. R.), & ULLSTRUP (A. J.). **Fungi associated with diseases of Cotton seedlings and bolls, with special consideration of Glomerella gossypii.**—*Phytopathology*, xxxi, 2, pp. 158–167, 3 figs., 1941.

Some of the information presented in this two years' survey (made in 1938 and 1939) of the fungal diseases, especially anthracnose (*Glomerella gossypii*) of cotton seedlings and bolls over a wide area, mainly comprised within the eastern section of the United States cotton belt has already been noticed from other sources [*R.A.M.*, xviii, p. 519; xix, p. 212; see also xx, p. 14], but mention may be made of the following points. The severe boll rots and characteristic pink spore masses of *G. gossypii*, as described in earlier reports of the disease, were seldom observed, the lesions for the most part consisting of limited spots indistinguishable from those produced by other organisms. This phenomenon is tentatively attributed to the unfavourable conditions for the pathogen induced by the adoption of early ripening cotton varieties of the open type. The scarcity of infection in Texas and Oklahoma may probably be ascribed to the dry climate, which precludes the survival of the fungus in a saprophytic form on the dead leaf and stem tissues from the damping-off to the boll rot phase. Evidence has been obtained to show that the admixture of infested trash with seed during ginning may be responsible for the development of damping-off in the seedlings. *Rhizoctonia* [*Corticium*] *solani*, the cause of severe damping-off, was isolated from a relatively small number of seedlings but was rather widely distributed.

MAKI (M.). **On the control of Crossocosmia sericariae Corn., a parasite of the Silkworm, by parasitic fungi.**—*Agric. & Hort.*, xv, 6, pp. 1279–1282, 1940. [Japanese. Abs. in *Rev. appl. Ent.*, A, xxix, 2, p. 88, 1941.]

Full-fed larvae of *Sturmia* (*Crossocosmia*) *sericariae*, a parasite of the silkworm (*Bombyx mori*) in Japan, were inoculated with *Spicaria fumoso-rosea* [*R.A.M.*, xviii, p. 380] prior to pupation in the soil. After 23 days a white growth appeared on both ends of the pupae, which were kept at a temperature of 15° to 30° C., and red spores were produced in 55 days. In soil saturated with moisture the percentage of infested pupae was high. In the laboratory the fungus also attacked silkworms, but it does not do so under field conditions. The best method of using it for the control of the parasite is probably by scattering the spores of *S. fumoso-rosea* in pupation sites.

SHAW (F. W.) & REID (D. J.). **Fungi and fungous diseases.**—*J. Lab. clin. Med.*, xxvi, 1, pp. 256–262, 3 figs., 1940.

The writers describe the clinical symptoms of several of the less familiar mycotic infections, namely chromoblastomycosis (*Phialophora verrucosa*, *Hormodendrum pedrosoi*, and *H. compactum*) [*R.A.M.*, xx, p. 164], *Torula* meningitis (*T. histolytica*) [*Debaryomyces neoformans* [ibid., xx, p. 115], and systemic histoplasmosis (*Histoplasma capsulatum*) [ibid., xx, p. 61], and indicate laboratory procedures for their diagnosis and differentiation from other diseases with which confusion is possible.

SMITH (L. M.). **Blastomycosis and the blastomycosis-like infections.**—*J. Amer. med. Ass.*, cxvi, 3, pp. 200–204, 4 figs., 1 diag., 1941.

The author has compiled a useful survey of some important aspects of the blastomycoses and kindred diseases, with special reference to their differentiation in practice, to facilitate which tables are given showing the geographical distribution of the infections, their clinical pictures and the prognosis as to the course of the illness, and their appearance in the tissues and in culture (also represented diagrammatically). The fungi listed in this connexion are *Blastomyces* [*Endomyces*] *dermatitidis*, *Coccidioides immitis*, *Paracoccidioides brasiliensis* [*R.A.M.*, xx, p. 163], *Hormodendrum pedrosoi*, *Phialophora verrucosa* [see preceding abstract], *Monilia* [*Candida*] *albicans*, *Sporotrichum schenckii* [see next abstract], *Scopulariopsis brevicaulis*, *Rhinosporidium seeberi* [ibid., xx, p. 18] (not grown artificially), and *Histoplasma capsulatum* [see preceding abstract]. Intracutaneous tests with fungous antigens (coccidioidin, blastomycin, sporotrichin, and oidiomycin) have afforded some assistance in diagnosis, but must not be regarded as absolutely specific for the purpose.

VIDAL (A.). **Esporotricosis en Honduras.** [Sporotrichosis in Honduras.]—*Rev. méd. Hond.*, *1939*, p. 199, 1939. [Abs. in *Bol. Ofic. sanit. panamer.*, xix, 2, p. 170, 1940.]

Sporotrichosis is stated to be of common occurrence in Honduras, where a number of cases have been observed and confirmed by cultural

studies since 1932. *Sporotrichum beurmanni* [*R.A.M.*, xviii, p. 178] was the agent of the disease in a 22-year-old male patient whose case is described, while *S. schenckii* [ibid., xix, pp. 93, 557] was responsible in other instances.

THORNER (JULIET E.). **Coccidiomycosis. Relative values of coccidioidin and tuberculin testing among children of the San Joaquin Valley.**—*Calif. West. Med.*, liv, 1, pp. 12–15, 2 graphs, 1941.

Tests were conducted simultaneously with 0·1 c.c. of Koch's O.T. 1:1,000 and coccidiodin from *Oidium coccidioides* [*Coccidioides immitis*] on 267 children [*R.A.M.*, xix, p. 472] selected at random from the Pediatric Clinic of the Kern General Hospital, and ranging in age from five months to 19 years. There was found to be a noticeably higher incidence of coccidioidin over tuberculin reactors as the period of residence in Kern County increased, amounting to 76 over 25 per cent. after ten years. Among a group of 42 patients with markedly positive skin reactions to the coccidioidin the stomach washings of only two proved positive for the fungus on culture and guinea-pig inoculation. The lower ratio of 'valley fever-coccidioidin' reactors observed in this and other surveys [ibid., xix, p. 593] points to the relatively benign as well as universal nature of the primary phase of coccidioidomycosis as it exists in the San Joaquin Valley. Progression into the later and severe granulomatous stage of the disease only takes place when tissue and lymphatic resistance are overcome and generalized dissemination is effected through the blood stream.

EMMONS (C. W.), HAILEY (HOWARD), & HAILEY (HUGH). **Chromoblastomycosis: report of the sixth case from continental United States.**—*J. Amer. med. Ass.*, cxvi, 1, pp. 25–28, 4 figs., 1 map, 1941.

The writers' case of chromoblastomycosis, the sixth to be reported from the United States, occurred in a 68-year-old farmer at Atlanta, Georgia, and presents three features of special interest, viz., the early diagnosis (at three months) of the disease, the unusual site of the lesion (dorsum of the left wrist), and the satisfactory response to potassium iodide therapy. The fungus isolated from the patient was entirely typical of *Hormodendrum pedrosoi* [*R.A.M.*, xx, p. 16]; it is fully described, with some considerations on its taxonomy and on the terminology of the associated disease.

DA FONSECA (O). **Brésil.** [Brazil.]—*Bahia med., 1939*, p. 33, 1939. [Abs. in *Bol. Ofic. sanit. panamer.*, xix, 2, pp. 166–167, 1940.]

Two types of 'piedra' have hitherto been recognized in Brazil, one very rare caused by *Trichosporon giganteum* [*R.A.M.*, xviii, p. 526], and the other, due to *Piedraia hortai* [ibid., xviii, p. 800], rife, especially among students. *Cladosporium wernecki* [ibid., xviii, p. 593] is responsible for a mild disturbance of the palms of the hands (tinea nigra palmaris) which appears to be peculiar to Brazil. Ringworms proper, though mostly cosmopolitan, also present certain problems of special interest in the country, notably those connected with the widespread interdigital epidermophytoses of the feet [*Trichophyton interdigitale*]

and their treatment by vaccinotherapy. 'Chimbêrê', a malady confined to certain native Indian tribes occupying the remote regions of the Brazilian-Bolivian frontier, is caused by *Endodermophyton roquettei* [ibid., x, pp. 105, 665], the agent of tinea imbricata or tokelau among the aborigines of the Pacific islands. The prevalent type of blastomycosis encountered is that associated with *Hormodendrum pedrosoi* [the taxonomy of which is discussed: see preceding abstract]. Of the blastomycoid granulomata, the most important, by reason of its gravity and prevalence in South America, is Lutz's disease, which demands a separate discussion.

SCHONWALD (P.). **Fungus allergies.**—*Northw. Med., Seattle,* xl, 1, pp. 17–19, 1941.

Following a brief discussion of the problem of fungus allergy [*R.A.M.*, xx, p. 15] and a résumé of some outstanding contributions to the subject, the writer describes the results of his survey of the atmosphere in the vicinity of Seattle, Washington, for mould spores [ibid., xvii, p. 395]. The outstanding feature of the investigation was the prevalence of *Penicillium expansum*, the agent of decay in apples, which may serve as a reservoir of infection. *Alternaria tenuis* is another frequent source of allergic disorders, while species of *Aspergillus*, *Hormodendrum*, and *Trichoderma*, all occurring more or less regularly and at times in large numbers, are also definitely allergic. Among 34 cases of uncomplicated mould allergies (representing less than 10 per cent. of all the inhalatory disturbances under observation), 6 were of asthma, 8 of rhinitis, 5 of bronchitis, and 15 of skin affections. Immediate and permanent relief follows therapy with the specific fungal extract.

ORLOV (F. M.). **The growth of certain dermatomycetes on different substrates.**—*Sovetsk. Vet., 1940,* 4, pp. 40–41, 1940. [Abs. in *Vet. Bull.*, xi, 3, p. 158, 1941.]

Of the 16 substrata on or in which emulsions of *Microsporon equi*, *Trichophyton equi*, and *T. gypseum asteroides* [*T. mentagrophytes*] were sown, viz., horsehair, cloth, leather, hay, oats, straw, horse dung, wood, sawdust, earth, clay, sand, brick dust, tap and distilled water, and physiological saline, the first seven gave rise to the most profuse growth, though all permitted some degree of development by the 20th day. The author has previously demonstrated the lengthy duration of viability of these fungi in stables, which should undergo thorough and repeated disinfection, together with all objects coming into contact with affected animals.

VANDAVEER (R. L.) & WILDMAN (J. D.). **Studies on the mold mycelia count of butter.**—*J. Ass. off. agric. Chem., Wash.*, xxxiii, 3, pp. 693–709, 10 graphs, 1940.

The following conclusions are drawn from the analysis by Wildman's method [*R.A.M.*, xvi, p. 536] of 1,345 cream samples from 29 churns supplied by direct shippers, cream routes, and cream stations in different States of the American Union. The presence and growth of moulds in cream were found to be associated with the development of decom-

position flavour characteristics, which in turn arose from adverse conditions of accumulation time, temperature, and sanitation prevailing on the farms of origin, very few of those inspected operating satisfactorily in respect of all three factors. Tests on the cleanliness of certain dairy utensils by the agar slice method on 99 farms revealed the presence of yeasts and *Oidium* [*Oospora*] *lactis* [ibid., xviii, p. 595] in 75·8 per cent. With one exception, all the butters made from creams of which 50 per cent. or more were mouldy showed a minimum of 40 per cent. mould mycelia, the average air temperatures during the process of conversion exceeding 72° F. Conversely, all 11 churnings of butter with a mycelial count of or above 57 per cent. contained more than 15 per cent. badly decomposed cream. A high mycelial count in butter was almost invariably correlated with an excess of acidity in the cream.

WILDMAN (J. D.). **Report on mold in butter.**—*J. Ass. off. agric. Chem., Wash.*, xxxiii, 3, p. 468, 1940.

Collaborative studies, not yet completed, on mould [including *Oospora lactis*] mycelia in butter [see preceding abstract] at the laboratory of the United States Food and Drug Administration (Microanalytical Division), have already produced one result worthy of immediate note. F. R. Smith, using the mould mycelia technique [*R.A.M.*, xvi, p. 536], found that the addition of one or two drops of 5 per cent. crystal gentian violet to the gum-butter mixture facilitates the detection of the hyphae (unpublished data). Although a stain is usually superfluous, its use under certain conditions may be advantageous, and a recommendation has been submitted to the appropriate subcommittee of the Association of Official Agricultural Chemists for the optional use of a dye as a part of the approved method.

LAURIE (A.) & WAGNER (A.). **Deficiency symptoms of greenhouse flowering crops.**—*Bull. Ohio agric. Exp. Sta.* 611, 26 pp., 20 figs., 1940.

The effects of nitrogen, phosphorus, potassium, boron, calcium, iron, magnesium, manganese, and sulphur deficiencies were studied in Ohio on *Begonia semperflorens*, *Calceolaria rugosa*, carnation, Valencia chrysanthemum, cineraria, *Fuchsia hybrida*, *Gardenia veitchii*, *Pelargonium hortorum*, *Hydrangea hortensis*, *Euphorbia pulcherrima*, *Primula obconica*, Talisman rose, *Antirrhinum majus*, and Lady Gay sweet pea plants grown in sand drip cultures in the greenhouse. The visual symptoms observed, to which a key is supplied, are described for each element. Nitrogen deficiency produced severe dwarfing of the whole plant, and a uniform yellowing of all, even the young leaves, which dried slowly, remaining on the plant for some time. Phosphorus deficiency resulted in severe dwarfing of the plant, unusually dark green foliage, sometimes with a greenish-purple cast, and a marginal leaf-yellowing followed by shedding. Magnesium deficiency led to a greatly reduced rate of growth with chlorosis on the lower part of the plant, yellowing and abrupt development of necrotic areas between the veins, which remained green, with puckering of leaves or leaf abscission in some types, and scarcity of roots, delayed blooming, and poor flower colour. Calcium deficiency was manifested by the death of nearly all

the feeding roots within two to four weeks, followed by that of the terminal bud, severe stunting, and eventual death of the whole plant. Manganese deficiency induced a chlorotic condition of the top leaves, the veins remaining green. Sulphur-deficient plants showed the veins lighter in colour than the rest of the leaf, this condition being the opposite to that found in any of the other deficiencies; the top leaves were affected first and the rate of growth was much slower than in healthy plants.

Blanton (F. S.) & Haasis (F. A.). **Three additional species of aphids transmitting Narcissus mosaic.**—*J. econ. Ent.*, xxxiii, 6, p. 942, 1940.

In a previous note (*J. econ. Ent.*, xxxii, pp. 369–370, 1939) the writers reported four species of aphids, viz., *Aphis rumicis*, *Macrosiphum solanifolii* [*M. gei*], *M. rosae*, and *Myzus convolvuli*, to be vectors of the narcissus mosaic virus [*R.A.M.*, xviii, p. 680], which has since been shown by further tests at Cornell University, New York, to be transmissible by another three, namely, *Anuraphis roseus*, *M. cerasi*, and *Macrosiphum pisi*. Out of 18, 36, and 31 Sir Watkin [daffodil: *Narcissus pseudonarcissus*] plants exposed to infestation under controlled conditions by *A. roseus*, *Myzus cerasi*, and *Macrosiphum pisi*, respectively, 13, 15, and 24, respectively, developed mosaic.

Gregory (P. H.). **The control of Narcissus leaf diseases II. The effect of white mould on flower and bulb crop.**—*Ann. appl. Biol.*, xxvii, 4, pp. 472–488, 2 pl., 7 graphs, 2 diags., 1940.

In an experiment on the control of white mould of narcissus (*Ramularia vallisumbrosae*) [*R.A.M.*, xix, p. 708] conducted from 1936 to 1940 in the Scilly Isles, the effect of spraying on the flower and bulb crop was studied on the variety Golden Spur planted in a 4×4 Latin square with wide unplanted guard strips between plots. Half of the plots were inoculated in December, 1936, a few weeks after planting, by placing on the ground withered leaves bearing sclerotia and this resulted in heavy infection. It appeared that every year the uninoculated unsprayed plants lost their foliage approximately two weeks earlier than similar plants sprayed by means of a knapsack sprayer at the rate of approximately 200 gals. per acre with Bordeaux mixture 4–4–40 plus agral 2 (4 to 6 oz. per 40 gals.) as a wetter; in 1937 the inoculated but unsprayed plots withered five to six weeks earlier than sprayed ones. Inoculated plots showed no increase in flower crop in 1938 over 1937 but gave increased yields in subsequent years when infected leaves were cleaned off the beds. When dead foliage was removed, sprayed plots were able to make about as much growth in two years as the untreated plots made in three. Spraying increased the flower crop, this effect being cumulative from year to year. Thus, the number of flowers per 100 bulbs planted in 1936 was 44, 114, 147, and 250 in untreated plots in 1937, 1938, 1939, and 1940, respectively, the corresponding figures for uninoculated sprayed plots being 41, 167, 251, and 422, respectively. Spraying improved flower quality, and in 1939 the total flower weight of sprayed plants was about 15 per cent. greater than

that of unsprayed. The bulb yields from sprayed plots were after three years about 80 per cent. heavier than those from the untreated; particularly the average weight of double-nosed and mother bulbs lifted was strikingly increased. Spraying did not increase the number of bulbs lifted and had no effect on the number of 'noses' lifted from plots planted with single-nosed bulbs, but it increased that lifted from plots with double-nosed bulbs by 37 per cent.; it also increased the average 'nose' weight by 46 per cent. Spraying resulted, however, in a marked retardation of leaf and flower development (as gauged by the half-crop date, the date when half the crop matures) varying from 6 to 8 days in 1938 to 4 days in 1939. This retardation reduced the market value of the increased crop. In 1938 the effect of retardation in lowering the average value per bunch from sprayed plots was more than made good by the larger flower crop obtained on the plots planted with double-nosed bulbs, whereas on plots with single-nosed bulbs, where the crop increase from spraying was not so great, the gross return was lower than from unsprayed plots.

Green (D. E.) & Tincker (M. A. H.). **Concerning Lilies infected with the mosaic virus.**—*Lily Yearb.*, *1940* (9), pp. 28–33, 3 figs., (1 facing p. 44), 2 graphs, 1940.

Lilies most commonly affected by mosaic in England [*R.A.M.*, xviii, p. 182] include *Lilium auratum*, *L. longiflorum*, and *L. speciosum*, especially recently imported stocks. Slate's observations as regards the susceptibility of the *elegans-umbellatum* group of hybrids [in New York: ibid., xv, p. 507] could not, however, be confirmed in this country. On the other hand, he omits from his list of susceptible varieties *L. candidum*, in which the dull pattern of the mosaic is not easily distinguishable. *L. regale*, though usually raised from seeds, has been found infected at the Royal Horticultural Society's Gardens at Wisley, but must still be left in the resistant category.

Under garden conditions mosaic spread rapidly in *L. speciosum* in spite of the roguing of diseased plants and attempts to control aphids with nicotine dusts. In the fourth season less than 5 per cent. of the plants of a stock purchased in 1933 were free from infection. The succession of foliage symptoms invariably observed was vein-clearing (frequently accompanied by slight discoloration); mottling, flecking, or streaking of the leaves which tended to curl upwards; and early leaf fall. No plant recorded as infected recovered and there was no seasonal disappearance of the symptoms in plants grown out of doors. One quarter of the plants with translucent veins produced at least one normal flower but every plant with streaked or mottled leaves showed severe floral symptoms. The adhesion of the petal tips is, it is stated, not diagnostic for mosaic and must be considered in conjunction with other symptoms. Stunted plants failed to flower. The bulbs of infected plants were small and showed a tendency to split into three or four small bulbs. Diseased bulbs have shortened scales and are open at the apex, these characteristics assisting the selection of a clean stock.

*L. auratum* behaved similarly but the decline was more rapid and the symptoms more severe.

Jenkins (Anna E.). **Ascochyta majalis identified on Lily of the Valley in the United States.**—Abs. in *Phytopathology*, xxxi, 1, p. 13, 1941.

In a nursery in south-eastern Pennsylvania in August, 1940, an elongated area, 20 by 2 ft., near the centre of a lily of the valley plot, 50 by 25 ft., was observed to be entirely discoloured, while outside this zone the green foliage was more or less generally spotted. An examination by the writer of representative specimens revealed the presence of *Ascochyta majalis*, only two previous records of which are extant, one from Verona, Italy (1899), and the second from the Austrian Alps (1908). Until the present outbreak, the pathogenic capability of the fungus had not been recognized.

Jones (L. K.). **Bacterial wilt of Carnation.**—*Phytopathology*, xxxi, 2, p. 199, 1941.

An apparently new bacterium, studies on which are still in progress, has been found responsible for a greyish-green discoloration of the foliage, followed by yellowing and death, of greenhouse carnations at Spokane, Washington, 30, 15, and 5 per cent. of the Kathryn, Melrose, and King Cardinal varieties, respectively, having succumbed, while another 11 varieties proved susceptible in inoculation tests, the minimum incubation period being 30 days following the inoculation of punctures at the stem base. Infection is most severe during warm spring and autumn weather. Cuttings taken from plants prior to the appearance of symptoms have transmitted the causal organism.

Burkholder (W. H.) & Pirone (P. P.). **Bacterial leaf spot of Gardenia.**—*Phytopathology*, xxxi, 2, pp. 192–194, 1 fig., 1941.

*Phytomonas gardeniae* n. sp. is the name proposed for a pathogen causing a foliar spotting of over 100 one-year-old gardenia plants in a greenhouse, observed at New Brunswick, New Jersey, in October, 1938. The lesions were ovoid to circular, up to 6 mm. in diameter, the brown to reddish-brown centres being surrounded by a narrow, water-soaked margin. The formation of several such spots on a leaf resulted in extensive yellowing and premature defoliation, more than half the foliage (mostly the lower) having dropped by the following January. Infection was equally severe on the Belmont, Veitchii (*Gardenia jasminoides*), Mystery, Hadley, and Piersons varieties, and on *G. radicans*, and is believed from circumstantial evidence to have been introduced on southern stock: the senior author, moreover, has observed an apparently identical disease on the same host in Florida.

In inoculation experiments on Veitchii plants the pathogen gave uniformly positive results in a moist atmosphere at 70° F. or above, infection occurring readily on young leaves but developing only as very small lesions on older foliage. Infection was facilitated if the leaves were injured by pricking. *P. gardeniae* is a narrow rod, occurring in pairs and occasional chains, sometimes slightly curved, measuring after 24 hours at 27° C. 1·4 to 3·5 by 0·5 to 1 (average 2·4 by 0·75) $\mu$, Gram-negative, with 1 or 2 polar flagella, forming white, later dirty, viscid colonies, and colouring the medium dark brown, clouding bouillon, clearing litmus milk in zones, liquefying gelatine, producing no hydro-

gen sulphide or indol, not hydrolysing starch, reducing nitrates to nitrites, utilizing with acid production dextrose, galactose, xylose, rhamnose, sucrose, maltose, mannitol, glycerol, and salicin, and evolving alkali from citric, malic, malonic, succinic, tartaric, and hippuric acid salts. *P. gardeniae* somewhat resembles *P.* [*Bacterium*] *solanacearum* in its cultural characters, but is non-pathogenic to potato. It falls into the *Pseudomonas* group of *Phytomonas* notwithstanding the apparent absence of a green-fluorescent pigment.

Black (L. M.). **Further evidence for multiplication of the Aster yellows virus in the Aster leaf hopper.**—*Phytopathology*, xxxi, 2, pp. 120–135, 1941.

This is an expanded account of the writer's studies [*R.A.M.*, xix, p. 281] on the multiplication of the aster (*Callistephus chinensis*) yellows virus in the aster leafhopper (*Macrosteles divisus*) [ibid., xx, p. 130]. The minimum incubation period of the virus in insects inoculated by mechanical means ranged from 11 to 45 days. Once the leafhoppers acquired viruliferous properties, they usually retained them until death. Better results in respect of mechanical transmission of the virus were obtained at 0° than at 25° C. The infective principle was largely destroyed in viruliferous insects by 20 minutes' freezing at −10°, and inactivated to a considerable extent during 24 hours' storage at 0° in leafhopper juice diluted to $10^{-1.5}$ with 0·85 per cent. salt solution. Experimental evidence was secured denoting that the virus multiplied at least 100-fold in the leafhoppers between the 2nd and 12th days of a 17-day incubation period, and reached a high concentration in its insect hosts six days before the latter transmitted it to asters. There is reason to believe that the virus concentration undergoes a decrease towards the end of the incubation period.

Green (D. E.). **Antirrhinum rust: IV. Improvement of rust-resistant varieties.**—*J.R. hort. Soc.*, lxvi, 3, pp. 83–86, 1941.

Much of the information in this progress report on the control of *Antirrhinum* [*majus*] rust (*Puccinia antirrhini*) in Great Britain through the development of resistant varieties has already been noticed [*R.A.M.*, xvii, p. 396], but mention may be made of the following items. Teleutospores of the fungus can survive the winter, but the alternate host they will infect has not yet been discovered. The uredospores do not normally retain their viability longer than six weeks, and it is therefore advisable to destroy all old plants at the end of the season and not to sow any seed for at least six to eight weeks thereafter. Experiments conducted with many infected seed samples sown in sterilized soil have demonstrated that the rust is not seed-borne [ibid., xix, p. 350].

The three stocks, viz., Wisley No. 3 (magenta), Orange Pink, and Terra Cotta Pink (the two latter American) showing resistance to the rust in the 1937 trials, comprising 900 plants of 16 stocks, were the only ones to maintain this reaction in the 1938 experiments on 740 plants of 21 stocks. In 1939, when 1,325 plants of 20 stocks were tested, full resistance was again exhibited by the three above-mentioned varieties, a yellow-flowered mutant from Terra Cotta Pink named Yellow Sport, and the newly imported American variety Brightness,

all of which gave equally promising results in the 1940 trials of 636 plants of 24 stocks. Provided that physiologic race 2 [ibid., xvi, p. 387] of the rust is kept out of the country, the writer hopes to improve the flowers of the present resistant varieties up to the standard of the best commercial sorts.

JENKINS (ANNA E.). **A new Ascochytella on Pentstemon from California.**—*Phytopathology*, xxxi, 2, pp. 194–197, 1 fig., 1941.

*Ascochytella pentstemonii* n. sp. [with English and Latin diagnoses], the agent of a severe stem spot of wild *Pentstemon spectabilis* in Los Angeles County, California, is characterized by cottony, salmon-pink colonies, dark pycnidia, 55 $\mu$ in height and 110 $\mu$ in diameter (up to 400 $\mu$ in pure culture on potato dextrose agar), and clear brown, usually straight but occasionally curved, uni-, less often bi- to triseptate conidia, 12 to 13 by 2 to 4 $\mu$ (in culture 12 to 21 [31 in the Latin diagnosis] by 4·5 to 6 $\mu$). The lesions produced by the fungus may attain 4 mm. in diameter and expand by confluence, sometimes involving the entire stem for 10 or more cm.; they are purple at first, becoming white or pale at the centre.

LIGHTLE (P. C.), STANDRING (ELIZABETH C.), & BROWN (J. G.). **Bacterial necrosis of the giant Cactus, Carnegiea gigantea (Cereus giganteus).**—Abs. in *Phytopathology*, xxxi, 1, p. 15, 1941.

A bacterial necrosis of the giant cactus (*Carnegiea gigantea*) is stated to have been long present in southern Arizona, and recently to have assumed an active form, causing the death of many plants. The area over which the disease extends measures 200 by 100 miles, but a much larger territory is believed to be involved. Only parenchymatous tissues are destroyed by the bacterium, which is believed to be new.

DARLING (LOUISE). **Protocoronospora on Phoradendron flavescens in California.**—*Madroño, S. Francisco*, v, 8, pp. 241–246, 3 figs., 1940.

In the spring of 1928, mistletoe (*Phoradendron flavescens* var. *macrophyllum*) parasitic on willows and poplars on the shore of Clear Lake, California, was found infected by an apparently new disease. Brown spots, 2 to 5 mm. in diameter, appeared on the leaves, later becoming confluent and covering most of the leaf surface. Lesions averaging 1 mm. in diameter, but very closely grouped, were also present on the stems. The fungus killed the host, and formed in abundance dark, erumpent sori containing spore masses over the surface of the dead leaves and stems. It is considered to be a new species of *Protocoronospora*, and is named *P. phoradendri* n. sp. [with a Latin diagnosis]. It is characterized by amphigenous, subepidermal, erumpent acervuli, exceptionally rare, dark brown setae measuring 30 to 50 by 3 to 4 $\mu$, clavate to cylindrical conidiophores 11 to 30 by 3 to 9 $\mu$, conidia abstricted from the tips or, more rarely, from the sides of the conidiophores, 1 to 9 (generally 5 or 6) at a time, small sterigmata not apparent until the conidia are shed, and conidia cream in the mass, straight when young, generally falcate when mature, measuring 15 to 26 by 4·5 to 6·5 $\mu$. Germination takes place only by the production of germ-tubes. The cultural characters are also described. The fungus differs

from *P. nigricans* in its longer acervuli, smaller setae, in the shape, size, and mass colour of the conidia, in germinating by germ-tubes and not by budding, and in its host.

CHILTON (S. J. P.) & GARBER (R. J.). **Effect of seed treatment on stands of some forage legumes.**—*J. Amer. Soc. Agron.*, xxxiii, 1, pp. 75–83, 1 fig., 1941.

Five seed disinfectants were tested in the greenhouse at the Pennsylvania State College for their relative efficacy in the control of damping-off [unspecified] of various species of *Lespedeza, Lotus, Medicago, Melilotus*, and *Trifolium*. New improved ceresan gave the largest increases in stand in *Lespedeza stipulacea, Medicago hispida, M. lupulina, Melilotus alba, M. indica, M. officinalis, Trifolium alexandrinum, T. hybridum, T. incarnatum, T. pratense, T. repens*, and the Ladino variety of the last-named, the surplus yield over the untreated controls ranging from over 3,200 per cent. in *T. alexandrinum* to 16 per cent. in *T. fragiferum* (which benefited equally from the use of vasco 4) [ibid., xvii, p. 642]. *Lotus corniculatus, T. dubium, T. glomeratum*, and *T. procumbens* failed to respond favourably to any of the treatments, *T. glomeratum* apparently being damaged by ceresan and cuprous oxide (cuprocide), while *T. subterraneum* was stunted by new improved ceresan at the maximum dose. In another test in which *M. suaveolens* was included the yield of this species was almost doubled by new improved ceresan.

In preliminary dosage studies with new improved ceresan on 12 legumes, concentrations of 1 to 1·5 per cent. generally gave the best results, but *Medicago hispida* and *T. alexandrinum* held relatively little of the dust and were most stimulated by a strength of 0·6 per cent. by weight. In two tests on *T. subterraneum*, ceresan was most effective at 1·5 and 0·75 per cent. and new improved at 0·75 and 0·375 per cent.

Considering the average relative efficiency of the five disinfectants in respect of increasing emergence and the control of post-emergence damping-off in 14 and 13 species, respectively, new improved ceresan heads the list with an average emergence of 60·4 per cent. compared with 28·1 per cent. for the controls. Ceresan, vasco 4, and Du Bay 1286 A were of some value (in the order named) for the objects in view, whereas cuprous oxide was of little or none.

WEIMER (J. L.). **Austrian Winter field Pea diseases and their control in the south.**—*Circ. U.S. Dep. Agric.* 565, 15 pp., 12 figs., 1940.

Popular notes are given on the symptoms, etiology, and control of the following diseases (listed in order of destructiveness) affecting Austrian Winter field peas (*Pisum* [*sativum* var.] *arvense*) in the southern States of the American Union: leaf spot and black stem (*Ascochyta pinodella* and *Mycosphaerella pinodes*) [*R.A.M.*, xix, p. 510], both of which were experimentally shown to be viable for over a year (two according to the literature) in old stems and the former for nine months and upwards in very dry soil alone, while instances are reported of their presence in the seed in an infective state for up to five years; leaf blotch (*Septoria pisi*); root rot (largely *Aphanomyces euteiches*) [ibid., xix, p. 709]; powdery mildew (*Erysiphe polygoni*); bacterial

blight (*Phytomonas* [*Bacterium*] *pisi*); downy mildew (*Peronospora pisi*); mosaic; *Fusarium* root rot (*F.* sp.); and stem rot (*Sclerotinia sclerotiorum*).

Rotation with non-susceptible crops, such as cereals, crimson clover [*Trifolium incarnatum*], bur clover (*Medicago arabica*), and vetches (common, Monantha [*Vicia monantha* = *V. calcarata*], and Hungarian [*V. pannonica*]), is advocated as the most practical measure for the control of leaf spot, black stem, and leaf blotch. No satisfactory means of combating root rot has yet been devised, but the rotation should be as lengthy as practicable, and damp, low-lying sites should be avoided. Rotation is also effective against bacterial blight and *Fusarium* root rot, while attempts are in progress to incorporate the resistance to powdery mildew of certain strains of peas into the Austrian Winter type by crossing.

ELROD (R. P.) & STARIN (W. A.). **A serological study of Erwinia amylovora isolates.**—Abs. in *J. Bact.*, xli, 1, pp. 87–88, 1941.

In studies at the Ohio University five strains of *Erwinia amylovora*, isolated from different hosts at different times, were found to be morphologically and physiologically distinguishable. Immune sera were prepared against living cultures of each strain and against somatic antigens, obtained by culturing the bacteria on phenol agar (1 in 1,000) followed by 30 minutes heating at 100° C., and from the results of agglutination tests the authors conclude that *E. amylovora* is an extremely homogeneous species from a serological point of view.

KEITT (G. W.), CLAYTON (C. N.), & MOORE (J. D.). **Experiments with eradicant fungicides in relation to Apple-scab control.**—Abs. in *Phytopathology*, xxxi, 1, pp. 13–14, 1941.

The clover sod 'floor' of an isolated 8-acre block of McIntosh apple-trees in an orchard near Casco, Wisconsin, was sprayed at bud-break with 0·5 per cent. elgetol [*R.A.M.*, xx, p. 169] plus 0·5 per cent. monocalcium arsenite at the rate of 300 gals. per acre. Counts made on 12th June, soon after petal-fall, showed percentage reductions in scab lesions per leaf of 99 and 95 per cent. in the treated block as compared with two non-sprayed orchards 0·3 and 0·5 miles distant, respectively. The 'floor' of a similarly isolated 4-acre McIntosh orchard in quack grass [*Agropyron repens*] sod was sprayed just before bud-break with 1 per cent. elgetol extra, 400 gals. per acre, resulting in scab lesion reductions on 13th June of 89 and 97 per cent. compared with the incidence of infection in two small untreated orchards.

SHARVELLE (E. G.). **An eradicant spray for the control of Apple scab and Raspberry anthracnose in Minnesota.**—Abs. in *Phytopathology*, xxxi, 1, p. 20, 1941.

Four rows of an experimental McIntosh apple orchard in Minnesota were treated in the spring of 1940 with a 'floor' spray of 0·5 per cent. elgetol [see preceding abstract] at the rate of 500 gals. per acre, and a regular spray schedule was applied to the whole orchard during the summer. In the autumn 1,000 apples selected at random from the 'floor'-sprayed rows showed only 4·1 per cent. of the fruit infected as

against 20·5 per cent. in a comparable sample from four control rows. Not only was the amount of diseased fruit reduced by the treatment, but the severity of infection was considerably mitigated.

Preliminary tests with 0·5 per cent. elgetol as a delayed-dormant spray gave promising indications in the control of raspberry anthracnose [*Elsinoe veneta*], infection by which was reduced from 100 to 80 per cent. of the 'hills' while the symptoms in the treated bushes were of a milder character than those in the controls.

HOCKEY (J. F.). **False sting—a virus disease of Apples.**—*Sci. Agric.*, xxi, 5, pp. 242–243, 1 fig., 1941.

In 1934 all the apples on a few apple trees in Nova Scotia were observed to show a deformity (locally termed 'false sting') superficially resembling pear stony pit [*R.A.M.*, xviii, p. 463], though no characteristic foliage or bark symptoms have been seen. Affected trees have borne 'sting' fruit regularly during their bearing years. The condition has been recognized on the varieties Gravenstein, Baldwin, Blenheim, Ben Davis, King, Northern Spy, and Tolman Sweet. Scions from an affected Baldwin tree were grafted on two young McIntosh trees in 1935, and some of the fruit produced on the McIntosh wood in 1938 and 1939 appeared to show the deformity. In 1940 the Baldwin scions and McIntosh stock each produced fruit, which in both varieties showed characteristic malformation. The condition appears to be a virus disease transmissible by grafting, and the only control would seem to consist in eradication. So far, comparatively few trees are affected.

PLAKIDAS (A. G.). **The mode of overwintering of Entomosporium maculatum in Louisiana.**—Abs. in *Phytopathology*, xxxi, 1, p. 18, 1941.

Of recent years *Entomosporium maculatum* (the imperfect stage of *Fabraea* [*maculata*: xviii, pp. 38, 259]) has assumed a severe form on Chinese sand pears [*Pyrus serotina* var. *culta*] in Louisiana, causing extensive defoliation in early summer. Dead leaves, which have long been observed to act as the source of inoculum, were examined periodically during the winter and spring of 1939–40 without yielding any ascospores, but conidia were found in abundance on overwintered material in the spring. Infection was obtained by placing dead leaves in cheesecloth bags on leafing pear branches in early spring. Under local conditions, therefore, the pathogen appears to hibernate in the mycelial stage on the dead foliage and produce conidia in the spring.

RICHARDS (B. L.) & HUTCHINS (L. M.). **A new virosis of Peach in Utah, resembling X-disease (yellow-red virosis).**—Abs. in *Phytopathology*, xxxi, 1, p. 19, 1941.

A virus disease of western chokecherry (*Prunus demissa*) and peach somewhat resembling X-disease (yellow-red virosis) [*R.A.M.*, xix, p. 548] was first observed in northern Utah on the former host in 1937 and on the latter in 1939, since when the prevalence of infection has increased in both species, ranging from a trace to 80 per cent. in the peach orchards inspected in 1940; older trees are the most susceptible. All 40 Elberta nursery trees inoculated by grafting on 26th July, 1940,

developed infection within six weeks. Distribution studies have shown that a high incidence of the new virus may be present on peaches in situations one mile or more distant from affected *P. demissa*, and in the area involved free spread from peach to peach may be assumed.

HOPPERSTEAD (S. L.) & MANNS (T. F.). **Buds as a factor in the over-wintering of shot-hole of Peach (Phytomonas pruni).**—Abs. in *Phytopathology*, xxxi, 1, p. 12, 1941.

The terminal buds of peaches were shown in three years' cultural and histological studies and field observations [? in Delaware] to harbour the causal organism of shot hole (*Phytomonas* [*Bacterium*] *pruni*) from one season to the next, the maximum number of positive isolations being obtained during the early part of the dormant period and declining rapidly thenceforward. Cultures of the pathogen were also secured from tissues showing no visible lesions along the last 10 to 12 in. of the tip end of the twig, the percentage of positive isolations obtained increasing progressively towards the tip. The intercellular spaces of the terminal buds were also found to contain masses of bacteria.

HAENSELER (C. M.) & DAINES (R. H.). **Peach canker caused by Fusicoccum amygdali.**—Abs. in *Phytopathology*, xxxi, 1, p. 10, 1941.

Peach trees in New Jersey and Rhode Island have recently been observed to bear oval, slightly sunken, brown, well-defined cankers, 1 to 3 cm. in length, nearly always situated at the nodes of young, but not actively growing, twigs and extending half-way round them. With age the cankers become hard, dry, and grey, and usually bear prominent, erumpent pycnidia exuding whitish spore tendrils in damp weather. The twig cankers may cause considerable direct injury, but their chief importance lies in the provision of infection courts for species of *Valsa*, the agents of a destructive blight. A fungus closely resembling *Fusicoccum amygdali* has repeatedly been isolated from the diseased tissues and inoculated into peach twigs with positive results.

REED (H. S.). **Effects of zinc deficiency on cells of vegetative buds.**—*Amer. J. Bot.*, xxviii, 1, pp. 10–17, 9 figs., 1941.

Continuing his earlier studies on zinc deficiency [*R.A.M.*, xviii, p. 43], the author presents the results of several years' investigations in California on the cytology of the apical meristem of shoots from healthy apricot and peach trees and others affected with little leaf from the orchard and from controlled cultures.

The evidence obtained [which is fully described] demonstrated that the first signs of cellular derangement in apricot buds become apparent in the strong affinity of certain meristematic cells for dyes, this being followed by premature vacuolization and polarization. This condition was observed in late winter, before the buds emerged from the resting stage. Initial derangement in peach buds appeared as vacuolization, with less pronounced hyperchromatization of the meristematic cells.

Observations of apricot and peach buds showed that buds of affected trees showed earlier and greater accumulation of phenolic materials than those of healthy trees. Decrease in phenolic compounds was a

feature of the growth of late spring and early summer in both healthy and affected shoots, and it is thought probable that certain phenolic compounds were utilized in metabolism. Both healthy and affected peach buds contained notable amounts of starch and calcium oxalate crystals towards the end of the growing season. The starch occurred chiefly in the cortex, the medullary rays, and the protoxylem, while the calcium oxalate was found mainly in the cortex, the medullary rays, and the pith cells.

The chief effects of zinc deficiency on the trees studied were seen in the hypoplasia induced, the polarization of cell contents, and the inhibition of cell multiplication in the region of the apex. The accentuated accumulation of phenolic materials in the vacuoles resulted in cell enlargement, and was in no instance associated with necrosis.

DUNEGAN (J. C.) & SMITH (C. O.). **Germination experiments with uredio- and teliospores of Tranzschelia pruni-spinosae discolor.**—*Phytopathology*, xxxi, 2, pp. 189–191, 1 fig., 1941.

Vigorous growth of the germ-tubes of *Tranzschelia* [*Puccinia*] *pruni-spinosae discolor* [*R.A.M.*, xvii, p. 756; xix, p. 418] uredospores occurred at a temperature range of 10° to 25° C., the optimum for germination probably lying between 20° and 23° [ibid., x,p. 470]. Germ-tubes on the water agar surface in Petri dishes may reach a length of 750 $\mu$. Variable results were obtained in experiments from 1934 to 1938 at Fayetteville, Arkansas, to determine the effect of environmental conditions on the longevity of uredospores of the rust from various *Prunus* hosts in different States, but storage in an electrical refrigerator at 5° definitely extended the duration of viability (up to 537 days).

Between 23rd February and 14th March, 1939, teleutospores of *P. pruni-spinosae discolor* from overwintered almond leaves in California gave rise within 24 hours to promycelia, basidia, and spores, development taking place from the small, distorted basal cell as well as from the apical [ibid., xix, p. 322]. The sole outstanding difference between the germinating teleutospores of the variety *discolor* from almond and those of the variety *typica* from *Prunus serotina* was in the position of the germ pores, which were near the septum between the two cells in the former, whereas in the latter the pore in the upper cell was apical and in the basal situated near the pedicel. The size and shape of the basidiospores also varied in the two forms, those of the *discolor* variety being subglobose, 8 to 8·5 by 6 to 6·5 $\mu$, and those of the *typica* variety reniform, 12·5 to 16 by 5·5 to 6·5 $\mu$.

**Strawberries resistant to red core disease.**—*Gdnrs' Chron.*, Ser. 3, cix, 2820, p. 14, 1941.

Following upon seven years' research, involving the testing of some 30,000 seedlings, five new strawberry varieties of good commercial quality and highly resistant to red core [*Phytophthora fragariae*: *R.A.M.*, xix, p. 608] have been released to growers under the names of Auchincruive 1, 2, 4, 5, and 6, Auchincruive being the name of the horticultural department of the West of Scotland Agricultural College from which the selection work was directed. A resistant variety

produced in the United States, and named American Aberdeen, has also been released.

BEAKBANE (A. BERYL). **Studies of cultivated varieties of Rubus and their hybrids. III. A comparative trial of Loganberry and Phenomenal Berry plants grown under different methods of training and spraying to control cane spot disease.**—*J. Pomol.*, xviii, 4, pp. 379–393, 2 figs., 1941.

A full account is given of a five-year trial at East Malling carried out with loganberry and phenomenal berry to ascertain the comparative value for commercial purposes of the two varieties, of four methods of training (as a fan, in one direction on double wirework, in one direction on single wirework, and by weaving), and of two spray treatments for the control of cane spot (*Elsinoe veneta*) [*R.A.M.*, xix, p. 715].

The results showed that loganberry was much more susceptible to infection than phenomenal berry. In 1937, infection was less on plants trained by weaving than by any of the other methods. Infection on fan-trained plants gradually decreased in relation to that shown by the other methods, until in 1939 it was lower on the fan-trained and weaving-trained plants than on the remainder. In the two one-way systems, plants at 6 ft. apart on double wire were more severely affected in 1939 than those 12 ft. apart on single wirework. No differences in vigour or yield resulted from the different spray treatments, but in 1937 plants given an application of colloidal copper in June showed less infection than the unsprayed controls, while in 1938, plants sprayed in May with Bordeaux mixture (2–3 hydrated lime–100) and in June with colloidal copper had less infection than others sprayed in June only.

LEACH (R.). **Banana leaf spot investigations. I. The basis of control.**—*J. Jamaica agric. Soc.*, xliv, 11, pp. 454–457, 1 fig., 1940.

In a study carried out in Jamaica in 1940 into banana leaf spot (*Cercospora musae*) [*R.A.M.*, xix, p. 260; xx, p. 153], observations were made of unfurling heart leaves to ascertain whether a close correlation could be found between the place of infection and the distribution of the spots on the leaves. In the closely furled leaf, the right side lies rolled up in the furrow of the upper surface of the midrib, the left side (with its lower surface towards the exterior) being rolled round the midrib and right side. Marks made daily along the edge of the opening leaf appear on the opened leaf as a series of lines parallel with the edge on the leaf side, but running obliquely across the leaf on the right. More lines appear on the left than right side, the former being exposed for more days than the right. As the evidence indicated that infection would occur more in narrow lines on the left than on the right side, a numerical estimation of spot distribution was made. The fourth, sixth, and eighth oldest leaves (excluding the heart leaf) were examined on ten affected plants in 28 localities, the left and right sides of each leaf being observed separately, and observations recorded on the intensity of the spotting and the percentage of spots seen in distinct lines. The results obtained showed that in five low-rainfall districts (50 plants) the percentages of spots in lines on the fourth, sixth, and eighth leaves

were, respectively, 37, 44, and 37 for the left side, and only 6, 11, and 11 for the right, the corresponding figures for 13 medium-rainfall areas (130 plants) being 55, 48, 41, and 17, 14, 9, and for 10 heavy-rainfall areas (100 plants) 62, 62, 55, and 17, 22, 14. These figures clearly demonstrate that a much higher percentage of spots appears in distinct lines on the left than on the right side. This result supports the view that the most important stage at which infection occurs is during the growth of the heart leaf. The first visible signs of spotting usually occur on about the fourth leaf and the slight difference noted between the relative distribution of the spots in the younger and older leaves strongly indicates that few infections take place after the heart leaf has opened.

While increase in the number of spots on a leaf is generally attributed to new infections, one case was noted where a gradually increasing number of spots was recorded on the left side of a leaf, though no spots appeared on the right for eight weeks. Though heaviest spotting often develops on the left side, especially on the younger leaves, there is less difference in intensity between the two sides in older leaves. If increase in spotting during ageing were wholly due to secondary infection from spores on the primary spots, the number of spots should increase relatively faster on the side showing the more primary spots. That such is not the case indicates that secondary infection does not occur freely.

GREATHOUSE (G. A.) & RIGLER (N. E.). **Quantitative comparison of methods for sterilizing solutions of organic compounds used in culture media.**—*Phytopathology*, xxxi, 2, pp. 149–158, 1941.

The losses in respect of fungicidal activity towards *Phymatotrichum omnivorum* [*R.A.M.*, xix, p. 592] from a number of typical organic compounds, including acids, phenols, amines, aldehydes, esters, amides, and glucosides, at 0·01 M concentration by the following methods of sterilization were compared: (1) autoclaving in the presence of water, nutrient medium No. 70 [the composition of which is indicated], or Czapek's solution, (2) intermittent steaming in the presence of water, and (3) dissolving the chemical in alcohol (95 per cent.) and adding usually not more than 1 ml. to each dry sterile flask, allowing the alcohol to evaporate through the plug (for one or two days), and then adding the sterile medium. Both (1) and (2) were found to occasion appreciable losses, whereas (3) except in the case of the most volatile compounds, caused little or no diminution of toxicity to the pathogen. Moreover, should such losses occur, they may be obviated by the addition directly to the medium of concentrated solutions of the compound to be tested in 50 to 95 per cent. alcohol.

DUJARRIC DE LA RIVIÈRE (R.) & HEIM (R.). **Les champignons toxiques. Caractères et détermination toxines, intoxications, thérapeutique.** [Poisonous fungi. Characteristics and determination of the toxins, their effects, and treatment.]—viii+59 pp., 8 col. pl., 5 figs., Paris, Encyclopédie Médico-Chirurgicale, Éditeur, 1938. [Received 1939.] 55 fr.

In this work, the authors state that they have brought together the best and most recent information available on poisoning due to different

species of the larger fungi. The subject is discussed under the headings: kinds of fungal poisoning, treatment, pathological anatomy, medico-legal diagnosis, and prophylaxis. Under the first section many of the species involved are described and accurately illustrated with excellent plates by A. Bessin, and notes are given on their toxicology. The aim has been to present the information in a strictly scientific, rather than a popular, form. Special mention must be made of the exhaustive bibliography, which runs to over 600 titles.

BENEDEK (T.). **Use of photomicrography in mycological research.**—*Chron. bot.*, vi, 9, pp. 201–202, 1 fig., 1941.

A description is given of special clamps made by the author to hold a test tube on the fixed stage of a microscope. They are interchangeable with the usual spring clamps, and while holding a test tube fast, allow it to be moved in any direction in the plane of the stage. The arrangement was devised to assist in photomicrography, for which the author recommends the use of a miniature camera.

SASS (J. E.). **Elements of botanical microtechnique.**—ix+222 pp., 33 figs., London, McGraw-Hill, 1940. 17s. 6d.

This manual of botanical microtechnique is designed to meet the needs of teachers of plant science, and those of beginners in research and is not intended primarily as a work of reference. The first part, comprising 120 pp., is given up to general principles and methods. The second part deals with specific methods recommended for the various phyla, pp. 150–160 being devoted to fungi. The concluding chapters concern the use of the microscope and photomicrography.

THOM (C.). **Out of the furrow.**—*J. Bact.*, xli, 1, pp. 1–15, 1941.

In this paper, a presidential address to the Society of American Bacteriologists at its 42nd annual meeting, St. Louis, 28th December, 1940, some of the problems confronting the author during his thirty years' experience as a collector of moulds are discussed in relation to certain practical applications of microbiological knowledge, with special reference to the control of *Phymatotrichum omnivorum*, the agent of cotton root rot in Texas, by means of the incorporation with the soil at the roots of the plants of potential fungal antagonists, experiments along which lines are still in progress.

Turning to the bewildering state of confusion prevailing in the matter of mould classification, instances of which are cited, the writer deprecates the practice of editors in permitting the publication of inadequately studied organisms as new species, and a plea is made for the appointment, by the Society of Bacteriologists, possibly in co-operation with other interested organizations, of referees for genera, species aggregates, or groups of organisms associated with specific processes, whose aid could be invoked in doubtful cases.

LEACH (J. G.). **Insect transmission of plant diseases.**—xviii+615 pp., 1 pl., 238 figs., London, McGraw-Hill Book Company, Inc., 1940. 42s.

This book is a very welcome addition to the literature of plant

pathology. It brings together for the first time the available information concerning the role of insects in the spread and development of plant diseases. After four introductory chapters in which more general aspects of the subject are discussed, there are chapters on plant diseases caused by toxicogenic insects, and the relation of insects to bacterial, fungous, and virus (two chapters) diseases, and phytopathogenic protozoa. A chapter is devoted to mites, nematodes, and other small animals as vectors, relevant aspects of the anatomy and physiology of plants and insects are dealt with, and a section on technique is included. An appendix lists 115 diseases (toxicity diseases 6, virus 70, bacterial 14, fungous 25), in the transmission of which some 200 species of insects are implicated.

Christenson (L. D.). **Insect vectors in relation to quarantine, eradication, and control of plant viruses.**—*J. econ. Ent.*, xxxiii, 6, pp. 827–830, 1940.

In connexion with a general discussion on the relations of insect vectors to the eradication of plant viruses by quarantine and other appropriate control measures, the writer enumerates 15 such carriers of well-known diseases in other countries which are not yet known to act in this capacity in the United States, if present there at all, and which should be rigorously excluded from entry under the Insect Pest Act of 1905.

Thornberry (H. H.). **A proposed system of virus nomenclature and classification.**—Abs. in *Phytopathology*, xxxi, 2, p. 23, 1941.

The system of virus nomenclature and classification [cf. *R.A.M.*, xx, p. 174] proposed by the writer is based on the infectious intracellular agents parasitizing the generally recognized groups of organisms, which are assigned to an Order (Biovirales) ancillary to the bacteria, consisting of three families, viz., (1) Rickettsiae, (2) Phytoviraceae, represented by the genera *Phytovirus*, *Pteridovirus*, *Bryovirus*, *Thallovirus*, and *Bacteriophagus*, and (3) Zooviraceae. The classification of members of (2) is founded on susceptible groups of organisms, modes of transmission, and symptoms on the respective standard hosts. The specific portion of the binomials for *Phytovirus* is compounded of the first syllable, or more, of the generic name of an important host, prefixed to a Latin word describing one of the main symptoms on a respective standard host, e.g., *Phytovirus nicomosaicum* var. *vulgare*. Six rules of proof for a virus disease of plants are suggested.

Dimond (A. E.) & Duggar (B. M.). **Effects of monochromatic ultra-violet radiation on the growth of fungous spores surviving irradiation.**—*Amer. J. Bot.*, xxvii, 10, pp. 906–914, 1 fig., 6 graphs, 1940.

Studies in Wisconsin on the ultra-violet radiation of spores of *Rhizopus suinus* are described, irradiation being effected with the full spectrum of the quartz mercury vapour lamp and with a quartz monochromator (2,650 Å). It appeared that the mycelia produced by irradiated and control spores grew at identical rates, but that in the case of the mycelium from spores surviving radiation growth continued over a longer period. The mycelial mats obtained from irradiated

spores were consequently as much as 20 per cent. heavier than those obtained from the controls.

Gossop (G. H.), Yuill (E.), & Yuill (J. L.). **Heterogeneous fructifications in species of Aspergillus.**—*Trans. Brit. mycol. Soc.*, xxiv, 3–4, pp. 337–344, 1 pl., 1940 [issued 1941].

The writers describe the occurrence, in mixed cultures on agar media of various strains of *Aspergillus niger*, *A. nidulans*, *A. cinnamomeus*, *A. schiemanni*, and related colour mutants of fructifications bearing two sorts of conidia [*R.A.M.*, xvii, p. 830], and comprising, in addition to those normal for the original strains, heterocaryotic sporophores and 'fused' sporophores. In the last-named each half of each sporophore represents one of the original strains planted. The heterocaryotic fused fructifications were confined to cultures of different mutants of one strain or to those in which one mould was a mutant from the other. They apparently arise as a result of mycelial anastomoses between related strains, which pave the way for nuclear migrations into the developing conidiophores, where repeated divisions take place and thereby furnish a supply of nuclei for the successively forming sterigmata; here again fresh divisions will occur and provide nuclei for the secondary sterigmata. The conidia borne on the latter, like the sterigmata themselves, are uninucleate.

Bald (J. G.) & Norris (D. O.). **The effect of the latent virus (virus X) on the yield of Potatoes.**—*J. Coun. sci. industr. Res. Aust.*, xiii, 4, pp. 252–254, 1940.

After stating that almost every plant of the six most commonly grown potato varieties in Australia would appear to carry at least one strain of potato virus X [*R.A.M.*, xix, pp. 38, 670], the authors describe an experiment carried out in 1939–40 to ascertain the effect of the presence of the virus on yield. The seed tubers used were of the President and Factor (Up-to-Date) varieties. The latter were derived from a single tuber which some years previously had been found free from virus X, this being the only X-free stock of any common Australian variety available. Before planting, the clean and infected tubers were indexed by inoculating from each to pepper [*Capsicum annuum*] plants. These tests confirmed the presence or absence of the virus, and demonstrated that the isolates were of average severity. The experiment was arranged so that the unit sub-plot consisted of three plants. Four sub-plots (President with and without, and Factor with and without, virus X) were randomized in a group along a row, similar groups occurring four times in each of five rows. Between adjacent sub-plots single clean President or Factor plants were set to reduce current-season infection between adjacent affected and healthy plants.

During the season no symptoms of virus X were noted on any plant, and no differences in vigour or growth habit were observed between healthy and affected plants of the same variety. In all, 182 plants grew, of which 90 were Factor and 92 President, 89 plants with virus and 93 without, gave yields. The mean yields per plant were 142 and 174 gm. for infected and clean President, respectively, and 148 and

240 gm. for infected and clean Factor, respectively. Thus, the mean loss in yield resulting from infection was 30 per cent. The mean number of tubers per plant was 6·8 and 8·9 for infected and clean President, respectively, and 4·0 and 4·9 for infected and clean Factor, respectively.

These results support the opinion that virus X is one of the main causes of the reduction in yield of potatoes in Australia. As, however, the effects of the virus are spread evenly over the crop, they escape notice.

Bald (J. G.), Norris (D. O.), & Dickson (B. T.). **The shape and development of Potato tubers and their significance in the diagnosis of spindle tuber.**—*Phytopathology*, xxxi, 2, pp. 181–186, 1 graph, 1941.

A disease of Factor (Up-to-Date) potatoes in New South Wales, diagnosed as spindle tuber, causes a decrease in the cross-sectional area relative to length in tubers of marketable size [*R.A.M.*, iii, p. 296], the shape of the smaller ones being unaffected. Three stages in tuber growth were differentiated by means of logarithmic curves based on measurements for sound and infected plants and the following characteristics noted in the diseased tubers: (1) the rudimentary tubers formed from the stolon tips are of normal shape, but smaller than those produced by healthy plants; (2) growth is uniform in all dimensions from about 0·75 to 2·5 cm. in length, causing lesser expansion in the second stage than that taking place in normal material; and (3) following a transitional period between the second and third stages, growth appears to pursue a comparatively normal course, but as predominantly apical growth begins in smaller diseased tubers, these are narrower in cross-section than sound ones of the same length. An analysis of the measurements made on Green Mountain tubers by Schultz and Folsom [ibid., iii, p. 548] and on Bliss Triumph by Werner [ibid., v, p. 625] gave results similar to those obtained from Factor.

Sanford (G. B.). **Studies on Rhizoctonia solani Kühn. V. Virulence in steam sterilized and natural soil.**—*Canad. J. Res.*, Sect. C, xix, 1, pp. 1–8, 2 figs., 1941.

In this further contribution to his studies of *Rhizoctonia* [*Corticium*] *solani* [*R.A.M.*, xvii, p. 620] the author discusses the pathogenic behaviour of this fungus to potato in natural and steam-sterilized soil. Inoculum obtained by growing various isolates on steam-sterilized black Edmonton loam was thoroughly mixed with natural virgin, cultivated, or steam-sterilized soil, and disinfected setts cut from tubers of Early Ohio potatoes planted in flasks of these soil mixtures. In both cultivated and virgin series it was evident that about one part of inoculum with 15 of the natural soil was more effective than larger proportions of inoculum; when equal parts of inoculum and natural soil were used, the virulence was distinctly reduced. The experimental results show conclusively that the fungus is much more virulent in the inoculated natural soil, with its natural complement of microflora and fertility, than in the same soil steam-sterilized and inoculated. Isolates that are normally very virulent were found to produce a very slight

amount of disease when potato sprouts grew through soil inoculum not mixed with natural soil. There was definitely less disease and the host more frequently escaped infection when grown in soil already permeated by vigorous growth of the pathogen than when host and pathogen met midway in the soil, owing to the fact that the soil was inoculated seven days after the sett was planted. The formation of sclerotia and the massing of mycelia was more common and abundant in the soil mixtures containing higher concentrations of inoculum than in those containing one part of inoculum to 15 of natural soil. Factors favouring the formation of sclerotia were a water content of the soil slightly above the optimum for the growth of plants and mycelium, an adequate supply of nitrate nitrogen, and a soil temperature range from 16° to 20° C., but especially the first-named. Conditions favouring marked vegetative growth of the pathogen tend to depress its virulence. Isolates of *C. solani* pathogenic to potato were again found to vary greatly in virulence and ability to form sclerotia, the *Corticium* stage being apparently an important source of pathogenic and sclerotia-bearing strains. Experimental evidence was obtained that soil-grown inoculum 180 days old proved to be as virulent as that six days old.

BERNAL CORREA (A.). **Las enfermedades del Arroz y su importancia económica en el Valle del Cauca.** [Rice diseases and their economic importance in the Cauca Valley.]—*Rev. Fac. nac. Agron. Colombia*, iii, 8–9, pp. 820–850, 1940.

This is a detailed account of the principal diseases affecting the increasingly important rice crop in the Cauca Valley of Colombia, namely, the leaf spots caused by *Helminthosporium oryzae* [*Ophiobolus miyabeanus*], *Cercospora* (possibly *C. oryzae*) and *Piricularia oryzae*; physiological scorch; chlorosis (white leaf), observed for the first time; and straighthead [see above, p. 197].

It has been experimentally shown that the spores of *H. oryzae* germinate between 4° and 40° C., with an optimum from 24° to 30°, coinciding exactly with the mean local temperature. The reaction to the pathogen of 17 varieties was tested under two systems of irrigation, flowing and flooding, of which the former tended to increase, and the latter to diminish, susceptibility. None of the varieties could be classed as highly resistant, the best results being obtained with Lady Wright, Fortune, Majagual, and Guacarí. In addition to appropriate cultural measures, including the flooding of the crop in 15 cm. of water from the first month after sowing until a fortnight before the harvest, seed disinfection may be practised with advantage, especially by means of five minutes' immersion in water heated to 55° to 60° or ten minutes at 53° to 55°, preceded by 24 hours' soaking in a cold bath. Treatment at 55° for five minutes reduced the incidence of infection from 25 to 1 per cent., the corresponding figures for uspulun dust (2 and 4 gm. per kg. seed), copper carbonate (same proportions), a three-minute dip in 1 per cent. mercuric chloride, and 2 per cent. formalin being 10, 8, 8·2, 7·7, 6, and 4 per cent., respectively.

So far the author has detected the presence of the *Cercospora* only on the foliage, interference with the photosynthetic functions of which may be productive of serious damage.

During the period of 1939 to 1940 covered by these investigations, the typical symptoms attributed to *P. oryzae* were in no case observed. Other workers, however, have encountered the 'brusone' disease in the Cauca Valley, and it is therefore probable that the climatic conditions at the time of the writer's visit were unfavourable to the development of the pathogen.

Chlorotic rice plants are recognizable from a distance by the lemon-yellow tone of their leaves, some of which may recover, while others die. The disorder is most conspicuous during two periods of the growing season, namely, between 30 and 60 days and from 100 days onwards, recovery being most frequent in the early attacks. Both the varieties most commonly cultivated in the Cauca Valley, Fortune and Guayaquil, are equally susceptible to chlorosis, but a high degree of resistance was shown at one farm by an early Italian variety, while promising results were also obtained in tests on the above-mentioned 17 varieties with Gigante Verccelli, Guayaquil (resistant type), Majagual, and others. The theory that chlorosis is due to lack of available iron in the soil [cf. ibid., xviii, p. 702] was not supported by experiments in which solutions of 1 to 5 per cent. ferrous sulphate were applied with negative results. A more beneficial line of treatment would appear to consist in the incorporation of organic matter into the soil.

Scorch is characterized by flaccidity and a yellow to deep red coloration of the leaves, leading in persistent cases to the death of the plants in 20 days. The predisposing cause of this disturbance is believed to reside in defective preparation of the soil and irregular irrigation, involving a loss of nutritional equilibrium; the breaking-up of compact masses of soil and uniform levelling are of great importance in control.

Straighthead is most prevalent in virgin soils containing an abundance of organic matter and receiving excessive irrigation. The distortion of the glumes, which is one of the typical features of the disease, is most in evidence in large-grained varieties, such as Fortuna and Guayaquil. Aeration of the soil through the periodical withdrawal of the irrigation water for five or six days is an effective means of control.

KLIPPERT (W. E.). **The cultivation of Hevea Rubber in tropical America.** —*Chron. bot.*, vi, 9, pp. 199–200, 1941.

The only serious problem in *Hevea* rubber cultivation in Central and South America is the leaf disease caused by *Dothidella ulei* [*R.A.M.*, xx, p. 77]. The effects of the fungus are so severe, that before rubber can be grown successfully in these areas, groups of immune or highly resistant clones must be developed. Dusting and spraying appear to be impracticable. Resistant clones are being developed chiefly by selection and artificial cross-pollination. It is fairly easy to select occasional resistant individuals from any seedling nursery, but difficult to obtain both resistance and high yield. Almost all the high-yielding clones developed in the Far East during the past 20 years are susceptible, but the material is useful in crossing with more highly resistant if lower-yielding clones. Suitable resistant clones will, it is expected, shortly be ready for commercial planting on a limited scale.

Garassini (L. A.). **Observación directa de la microflora del suelo por el método de Rossi-Cholodny-Conn.** [Direct observation of the microflora of the soil by the Rossi-Cholodny-Conn method.]—*Rev. Fac. Agron., La Plata,* xxiv (*1939*), pp. 45–56, 3 pl., 2 figs., 1940. [English summary.]

Details are given of the examination, at the La Plata University, Argentina, by Conn's modification (with variations) of the Rossi-Cholodny technique [*R.A.M.*, xviii, p. 128], of four soil samples: (1) garden manured with dung, (2), (3), and (4) under lucerne, broad beans, and wheat, respectively, the results of which showed that Actinomycetes predominate in the first-named and were also abundant in (2) and (3), accompanied by *Alternaria* spores in (1) and (2), and by those of '*Oidium*' in (3); the wheat soil, on the contrary, yielded more fungal mycelium and *Fusarium* spores than Actinomycetes.

Godoy (E. F.). **El 'mildew' o 'tizón' del Pimiento producido por la 'Phytophthora capsici' en la República Argentina.** [The 'mildew' or 'blight' of Chilli produced by *Phytophthora capsici* in the Argentine Republic.]—*Rev. Fac. Agron., La Plata,* xxiv, pp. 235–280, 7 pl., 1 fig., 1 map, 1940. [English summary.]

This is a comprehensive, fully tabulated account of the writer's field observations and laboratory studies on chilli (*Capsicum annuum*) blight (*Phytophthora capsici*) in the Argentine [*R.A.M.*, xviii, p. 85], where it was first observed by Lindquist in La Plata during the 1931–2 season [ibid., xii, p. 535] and is now known to occur in the north (Salta and Jujuy), Cuyo (Mendoza), and along the coast, assuming its maximum economic importance in northerly regions. The symptoms of the disease in northern Argentina approximate more closely to those described by Leonian from New Mexico and Weber in Florida [ibid., xii, p. 112] than to the features noted by Lindquist.

The mycelium of the pathogen, both intra- and intercellular, is situated principally in the cortical parenchyma of the infected stem and branches: the mesocarp of the fruits is likewise invaded, cellular disorganization in both cases being induced by the dissolution of the pectin. Both nursery and field plants are affected. The shape of the moist, rugose, dull green lesions differs according to the variety of *C. annuum* attacked, being circular in vars. *abbreviatum* and *cerasiforme* and elongated in vars. *acuminatum* and *largum*; the entire fruit is ultimately involved in either type. The organism was isolated in pure culture on a number of standard media and identified as *P. capsici*. Branches, fruits, and seeds all yielded the fungus, the last-named organs being invaded through the teguments and aleurone layer and thus serving, together with the previous season's haulms, as a source of perpetuation of the disease. Direct penetration of the host through the stem base was shown by inoculation experiments on the Ruby King variety to be possible at the age of 70 days, but the parasite usually enters through wounds inflicted on plants of any age by insects, cultural practices, hail, frost, or other natural agencies. Inoculation tests on other Solanaceae gave negative results.

The optimum temperature and relative humidity for the development of chilli blight epidemics are 24° to 26° C. and over 70 per cent.,

respectively; the prevalence of these conditions influences the host-parasite complex by inducing a state of predisposition to infection in the former and simultaneously promoting the rapid growth of the latter. Both mild and pungent varieties of *C. annuum* are liable to infection by *P. capsici*, the former, however, sustaining much heavier damage (90 to 100 per cent.) than the latter (10 per cent.). In addition to varietal susceptibility, other cultural factors favouring outbreaks of blight are continuous cultivation and the timing of the crop in such a way that the critical stage for infection develops during the rainy period from the end of December to March.

Sardiña (J. R.). **Acerca de la 'blanqueta' del Pimiento (nota preventiva).** [Concerning the 'blanching' of Chilli (preliminary note).] —*Bol. Pat. veg. Ent. agríc., Madr.*, ix, 35–38, pp. 1–8, 7 figs., 1940.

Considerable damage is stated to be inflicted on the increasingly valuable chilli crop of Valencia, Spain, covering an area of 2,000 ha., by a virus disease known as 'blanching', salient features of which include mottling and crinkling of the small and medium-sized leaves; the distribution of the normal green and pale green to yellow chlorotic zones is somewhat erratic, but the former tend to be interveinal and the latter to involve the tissues running parallel with the veins. On larger leaves the mottled areas are more extensive, but less numerous, than on the younger foliage, while crinkling is barely perceptible. The skin of affected fruits is of a granular texture with striation or slight creasing of the surface. The virus of 'blanching' was experimentally shown to be transmissible by means of the aphid *Myzus persicae*, as well as by the juice, from diseased to sound plants, but the seed is considered to be of little or no importance as a source of infection, only five out of 173 plants raised from 'blanched' seeds presenting faintly suspicious symptoms in the form of foliar crinkling but no trace of spotting.

Hoerner (G. R.). **The infection capabilities of Hop downy mildew.**—*J. agric. Res.*, lxi, 5, pp. 331–334, 1 fig., 1940.

In inoculation experiments carried out in Oregon between 1931 and 1937, the following hosts, all belonging to the Urticaceae, were successfully infected with the hop downy mildew fungus, *Pseudoperonospora humuli* [*R.A.M.*, xix, p. 302]: several commercial varieties of *Humulus lupulus*, *Celtis mississippiensis*, *C. occidentalis*, *C. sinensis*, *C. tournefortii*, hemp, *H. lupulus* var. *neo-mexicanus*, and *Urtica lyallii*, while *H. japonicus* and its variety *variegatus* both showed some evidence of resistance. In view of the fact that species of the genera *Cannabis*, *Celtis*, *Humulus*, and *Urtica*, which are hosts, respectively, of *P. cannabina*, *P. celtidis*, *P. humuli*, and *P. urticae*, all became infected with *P. humuli*, it is suggested that the four pathogens may prove to be only different physiologic races of a single species of *Pseudoperonospora*.

Santos (P. R.). **Leaf spot of Derris.**—*Philipp. Agric.*, xxix, 8, pp. 641–659, 6 figs., 1941.

Leaf spot is stated to be a prevalent disease of *Derris* spp. in the cultures of the College of Agriculture, Philippine Islands. It also occurs in the Los Baños Economic Garden, the Laguna Provincial Nursery,

where 60 to 70 per cent. of the leaves were affected in July, 1940, and on plants growing on Mount Maquiling. Hybrids of *D. elliptica* and other species and strains of *D. elliptica* and *D. philippinensis* are also severely attacked.

At first, infection appears as minute, brown, circular dots, visible on both sides of the leaf, and surrounded by a band of transparent, greenish or yellowish tissue about 1 mm. wide. This band is surrounded by another, of more or less water-soaked, greenish tissue. Affected leaves become variously distorted, especially when several spots coalesce. In the advanced stage the spots measure 4 to 5 mm. in diameter, and are circular, reddish- to dirty brown, with a distinct brown border about $\frac{1}{3}$ mm. wide, and surrounded by indistinct and diffused yellowish areas. Later, the dry central portion of the spots on the younger leaves falls out, giving the leaves a shot-hole effect. On the older leaves the spots remain circular, and the centres do not drop out. These spots are greyish-brown and thin. In old lesions and during damp weather minute, black pycnidia are found scattered over the spots.

The fungus showed black (light brown when young), globular to flask-shaped pycnidia measuring on the host 45 to 240 $\mu$ high by 22·5 to 217 $\mu$ broad (average 138 by 101 $\mu$), with one to three ostioles, 5·1 to 15·3 (average 9) $\mu$ in diameter, and containing hyaline, ellipsoid to elongate pycnospores, 4·4 to 6·4 by 1·6 to 2·8 (average 5·3 to 2) $\mu$. On sterilized *Derris* leaves the fungus produced abundant, deep brownish-drab, later black pycnidia, 120 to 570 $\mu$ high and 9 to 275 $\mu$ broad, but none was formed on various agar media tested, of which potato dextrose agar yielded the best growth. In inoculation experiments, infection was noted 24 hours after the mycelium was smeared on *Derris* leaves, and four days after an aqueous suspension of the pycnospores had been sprayed on the plants. In cross-inoculation tests, infection of 13 species belonging to 12 genera from 7 families was obtained. The fungus is identified with *Phyllosticta derridis* P. Henn. though its pycnidia and pycnospores are larger.

Infection appeared to be favoured by damp, cool weather and shady situations, and spore dissemination would seem to take place by means of wind, insects, and splashings from diseased plants. The organism survives unfavourable conditions in the infected host tissues, either on the plant, or on the ground. The author recommends that every effort should be made to prevent the spread of the disease into new areas. Plant disease sanitation should be enforced. *Derris* should be planted in the open, not between trees in orchards, under coco-nuts, or with permanent crops, and a reduction of shade is also advisable. A limited test suggested that spraying with Bordeaux mixture (4–4–50) at monthly intervals from January to September may reduce infection to negligible proportions.

McIntosh (A. E. S.). **Report on a third visit to Jamaica. October, 1940.** —*Bull. Brit. W. Ind. centr. Sug. Cane Breed. Sta.* 22, 17 pp., 1940.

The author states that mosaic disease is now present in all the sugar-cane growing areas of Jamaica [*R.A.M.*, xix, p. 494]. The evidence indicates that at least two, and probably three, distinct strains exist. Effective commercial control is carried out on B.H. 10 (12) at Serge

Island, Frome Estates, Rose Hall, Richmond, and parts of Worthy Park, but in other districts, either because effective control is not the rule, or because the natural environment is highly favourable to the disease, mosaic is prevalent, and is not commercially controlled in this variety. In many such localities B.H. 10 (12) gives good yields in spite of heavy infection. In other parts, B.H. 10 (12) is replaced by commercially resistant types, such as P.O.J. 2878, P.O.J. 2727, M. 28, and F.C. 916.

In most instances, mosaic is so widespread that roguing would be impracticable, and a complete change to resistant types would be necessary. The growing of such canes alone for a few years might be followed by a gradual re-introduction of healthy seed of susceptible varieties, together with the routine growing of seed nurseries, and roguing in them and in plant-cane crops. The usefulness of this method of control would of course depend on whether permanent alternate hosts existed in the vicinity or not.

At the time of the author's visit, 63 seedlings had been received in Jamaica from the Central Cane-Breeding Station. Of these, B. 3013 did well in trials, and should be further tested in good soils with light infestation if it proves to be not more susceptible than B.H. 10 (12). B. 3439 has given exceptionally promising results as a plant cane and is also highly resistant. B. 3254 and B. 35187, which showed much promise in Barbados, were also found resistant in Jamaica. B. 34110 and B. 35204 have shown resistance; the former is suitable only for good soils, but the latter is a general-purpose cane.

It is suggested that whenever planting material is available at Cow Park from a batch of seedlings, planting should be carried out at Hope Gardens to determine reaction to mosaic, so that the status of any seedling in relation to mosaic would be known before extended multiplication and outside distribution had occurred. Twelve stools of any seedling grown in a row would be sufficient. The row should be broken half-way by two stools of B.H. 10 (12) planted from clean material at the same time as the seedling, to serve as a standard of comparison. These rows should alternate with diseased rows obtained by planting affected material of a susceptible variety. Maize should be interplanted at definite intervals through the testing area to attract aphids. The degree of resistance or susceptibility should then be expressed as a comparison with that of B.H. 10 (12), any seedling more susceptible than the standard cane being eliminated. The surviving seedlings should be grown under observation over a wide range of ecological conditions, representing those found in the Jamaica cane-growing areas. Three types of seedlings should be recognized, viz., those suited to good and poor soils, respectively, and general-purpose canes.

It is regarded as imperative that schemes for multiplication and testing should be established as a routine, according to a fixed system, such as that suggested. Emphasis is also laid on the necessity for an investigation into the sugar-cane mosaic problem in Jamaica.

Rafay (S. A.) & Padmanabhan (S. Y.). **Strains of Colletotrichum falcatum Went.**—*Curr. Sci.*, x, 1, pp. 25–26, 1941.

Three distinct types of culture of *Colletotrichum falcatum*, the agent

of red rot of sugar-cane, developed from isolations made in the course of an epidemic in North Bihar, India, in 1939 to 1940, viz., A, characterized by white, later pale grey, cottony, floccose colonies without slimy, pink masses of conidia; B, forming loose, silky colonies, gradually becoming more compact, of an indeterminate shade of grey, abundant dark pseudo-pycnidial masses, and slimy masses of salmon-coloured conidia, growing much faster than A on oatmeal agar; and C, of a compact, velvety texture, darker than A, producing conidia sparsely, and possibly representing an intermediate stage between A and B. Types A and C appear to correspond closely with Abbott's light and dark races, respectively, except for the absence of masses of conidia in A [*R.A.M.*, xviii, p. 344], a culture sent to the United States for comparison being assigned to the dark one.

In inoculation experiments with A and B on the Co. 213, 299, 421, and B. 04 varieties the index of virulence, judged by the rate of spread of the fungus in the setts and calculated by dividing the length of the sett by the length of spread of the organism, was as follows: A in the four varieties in the order given 3·71, 1·49, 2·08, and 1·37, respectively; B, 1·96, 2·52, 2·95, and 4·35, respectively.

Padwick (G. W.). **The red rot epidemic.**—*Indian Fmg*, i, 6, pp. 263–267, 1940.

During the season 1939–40, infection of Co. 213 sugar-cane in northern India by *Colletotrichum falcatum* [*R.A.M.*, xviii, pp. 344, 619] reached locally unprecedented proportions, the attack representing a new phase in the history of the disease in India.

Discussing possible sources of infection, the author states that over a large area of northern India conditions are not very suitable for spore production, especially on the canes. As a rule, spores develop only when the affected canes have completely rotted. During the monsoon, however, the midrib parts of the leaves may bear numerous acervuli, and if conditions permit germination, spores can be spread, with the result that if suitable cane material is available, infection will occur from this source. Locally, diseased setts are a major source of infection. The part played by borers is not precisely known. In the epidemic under discussion, the type of root primordia infection found by Abbott on P.O.J. 213 in Louisiana [ibid., xviii, p. 345] was seen on Co. 213. Possible sources of the fungus comprise mycelium in the mother setts, spores from diseased shoots, leaf spots, and old decayed, diseased canes, spores or mycelium in the soil, and spores from alternate hosts, if any. The fungus may enter the canes from the mother sett to the new shoots, or through borer holes, root primordia, and leaf scars (i.e., the nodal region), the cut end of setts, and various injuries. Leaf entry may take place directly through the epidermis, through insect punctures, and through miscellaneous injuries.

The epidemic may have been induced by the predominance of a vigorous race of the pathogen, as happened in Louisiana [loc. cit.], carelessness in selecting setts for planting resulting in a gradual increase of infected material, until almost the entire stock of Co. 213 had become infected. There is no evidence that Co. 213 was at any time genetically resistant; tests at Pusa at least four years ago proved it to be one of

the most susceptible varieties. Observations during the epidemic showed no correlation between insect attack and infection. The disease was found in soils free from waterlogging, and there is no evidence that susceptibility induced by unfavourable soil conditions is progressive or inherited.

Growers are advised to grow seed-cane material on small plots of well-drained land not situated in low-lying areas. In these plots the crop must be frequently rogued throughout the growing season. The introduction of healthy seed from districts where infection is negligible should be encouraged, at least for planting in nurseries, but it must not be assumed that such material is resistant. The opinion prevalent in some quarters that Co. 299 and Co. 331 are resistant is without foundation. The introduction of healthy material of these varieties would be helpful initially, but without strict supervision of planting practices these varieties will meet the same fate as Co. 213.

BOURNE (B. A.). **Sugar Cane varieties in Florida.**—*Facts ab. Sug.*, xxxv, 12, pp. 23–27, 7 figs., 1940.

In the course of this survey of the activities of the Agricultural Research Departments of the United States Sugar Corporation in the Everglades region of Florida, the writer points out that selection for disease and pest resistance is a matter of fundamental importance, since without this character only low yields would be possible. Of the major diseases, the following disorders caused by *Helminthosporium*, viz., eye and ring spots [*H. sacchari*] and brown stripe [*Cochliobolus stenospilus*: *R.A.M.*, xx, p. 178], mosaic, root rot, and red rot [*Colletotrichum falcatum*], have been the chief objects of attention. As an example of successful breeding along these lines may be cited the F. 31–436 variety, the principal rival of the former standard P.O.J. 2725 for Okeechobee muck (custard apple) soils, the ancestry of which comprises one-quarter of D. 74 (an old Louisiana commercial strain) 'blood', while Louisiana Purple and Chunnee are represented through P.O.J. 213 and *Saccharum spontaneum* through P.O.J. 2725. The new selection is very resistant both to the *Helminthosporium* infections and mosaic.

BOURNE (B. A.). **Eye spot of Lemon Grass.**—*Phytopathology*, xxxi, 2, pp. 186–189, 1 fig., 1941.

Pure cultures of a species of *Helminthosporium* isolated from lemon grass (*Cymbopogon citratus*) in the Florida Everglades were grown on sterile leaves and maize meal agar, and found to correspond exactly in spore dimensional and other morphological characters with *H. ocellum* (or *H. sacchari*) [*R.A.M.*, xiii, p. 12] from B. 3124 sugar-cane. The only previous record of the fungus on a host other than sugar-cane is that of Voorhees, who observed it, also in Florida, on *Pennisetum purpureum* [ibid., xvii, p. 754]. On *C. citratus*, however, the colour of the lesions differs from that described for the other grass host, four zones being distinguishable at maturity, viz., a pale flesh- or straw-coloured centre, surrounded by a dark purple, narrow, oval border, encircled in turn by a Spanish raisin-coloured zone, and finally by a yellowish- to flesh-tinted areola; at this stage the spots measure 4 to 10 by 1·5 to 2 mm. Inoculation experiments with the fungus from *C. citratus* gave positive

results both on the original host and on Otaheite sugar-cane, and conversely, an isolate of *H. ocellum* from the B. 3124 sugar-cane proved capable of attacking lemon grass.

BELL (A. F.). **Report of the Division of Entomology and Pathology.**—*Rep. Bur. Sug. Exp. Stas Qd, 1939–40*, pp. 16–20, 1940.

The following items are included in this report [*R.A.M.*, xix, p. 236]. It is proposed to remove the sugar-cane H.Q. 285, which is susceptible to gumming disease (*Bacterium vasculorum*), from the approved variety list for 1941; it is hoped that once the infection centres of the now non-approved S.J. 4 have been removed, spread of infection to the more resistant standard varieties such as Badila and H.Q. 409 will be curtailed [ibid., xix, p. 116]. In resistance trials conducted at Bundaberg, the variety Co. 515, a cross between P.O.J. 2725 and sorghum, proved more susceptible to the gumming disease than the susceptible standards; Q. 13, Q. 20, and the Hawaiian 31–1389 appeared highly resistant, and Q. 10 commercially so. In an uncompleted trial at Brisbane Q. 28, Q. 29, and the Hawaiian 28–4291, 31–2484, 31–2806, 32–1063, 32–3575, and 32–8560 appeared to be satisfactorily resistant.

The Fiji disease situation is stated to be rapidly improving in southern Queensland owing to the extensive control campaigns carried out by the local Cane Disease Control Boards [ibid., xix, p. 236; xx, p. 144]. In resistance trials it was found that although P.O.J. canes transmit susceptibility to Fiji disease to a large proportion of their progeny, some highly resistant seedlings are produced. In resistance trials completed during the year, no infection was found on Co. 352, Co. 355, or Co. 356; 0 to 10 per cent. infection on Q. 42, Q. 43, and Q. 813; 10 to 20 per cent. on Q. 2 and S.C. 12/4; and 20 to 40 per cent. on P.O.J. 2878 and D. 1135.

Downy mildew (*Sclerospora sacchari*) [loc. cit.], which is stated to be still the most important disease of sugar-cane in Queensland, is reported from the Mossman, Cairns, Lower Burdekin, Mackay, and Bundaberg districts. Owing to the extent to which the disease spreads from diseased fields of P.O.J. 2878 to the more resistant standard varieties, it became necessary in 1938 to prohibit further plantings of this variety over most of the Mackay district. Field observations indicate that downy mildew can spread within a radius of ¼ mile, or in a few cases, of one mile. By comparing the number of diseased stools per unit area in Bundaberg, the varieties P.O.J. 2878, P.O.J. 213, P.O.J. 234, and D. 1135 (in that order) were found to be the most susceptible; Co. 290, P.O.J. 2725, Q. 813, and 1900 Seedling fairly resistant; and Mahona (N.G. 22), grown on the river flats, fairly susceptible. It was observed that, as a general rule, late harvested ratoons developed more downy mildew than those harvested early. This is explained by the facts that (*a*) early cut cane is often harvested before the fungus has penetrated into the crown of the stool and the diseased stool is cured by excision; and (*b*) ratoons of late cut cane are exposed to heavier sources of infection while they are still young and therefore more susceptible. Downy mildew was again found to pass easily to maize [ibid., xix, p. 166] and also to teosinte (*Euchlaena mexicana*). Sorghum was generally more resistant than maize: no definite symptoms developed on any of the

sorghums tested in Brisbane, but at Bundaberg fairly heavy infection was observed on American Early Red and unconfirmed leaf markings on Schrock sorghum; at Mackay one plant of Coleman sorghum became infected and others showed suspicious markings. Taking account of the danger to sugar-cane crops from maize infected with downy mildew a proclamation has been recently issued in the Bundaberg area providing that no maize crop can be planted and grown without a written permit. In a ratooning experiment the susceptibility of P.O.J. 2725 to downy mildew was greatly increased by ratooning in summer. Hot-water treatment of diseased setts for 20 minutes at 52° C. gave partial control of downy mildew, and 20 minutes at 54° and 10 minutes at 56° appeared completely effective. In resistance trials at Cairns no infection was observed in varieties Q. 13, Q. 29, Badila, H.Q. 409, or H.Q. 458; 0 to 10 per cent. infection in Q. 2, Q. 19, S.J. 4, H.Q. 426, Oramboo, Korpi, P.O.J. 2725, and B. 147; 10 to 25 per cent. in Q. 10, Q. 44, Pompey, D. 1135, and Co. 290; 25 to 50 per cent. in Q. 27, P.O.J. 213, and P.O.J. 2878; and over 50 per cent. in Co. 419, P.O.J. 2940, and S.J. 16. In trials at Bundaberg no infection was found in Q. 20, Q. 29, Atlas, Juno, Oramboo, 90 Stalk, E.G. 1, Co. 515, or *Erianthus*; 0 to 10 per cent. infection in Q. 10, Q. 13, Q. 27, Q. 43, Q. 813, 1900 Seedling, and P.O.J. 213; 10 to 25 per cent. in Q. 23; 25 to 50 per cent. in Co. 356 and 31–1389; and over 50 per cent. in P.O.J. 2878.

In continued experiments on the control of chlorotic streak [ibid., xix, p. 237; xx, p. 178] it was found that setts of Badila averaging 3·75 cm. diameter and pre-heated for two to three minutes gave rise to apparently healthy plants after immersion in water at 44° for 20 minutes. When individual buds on diseased stalks were selected at random and the buds only treated with flowing water at 52° for 20 minutes, 17 out of 23 untreated buds gave rise to diseased plants as compared with 14 treated buds, suggesting that the infection is not restricted to the bud. When selected portions of a stalk with several nodes on each were treated, in a rubber sleeve, with water at 52° for 20 minutes, complete control was achieved, while the eyes above and below the treated sections gave rise to diseased shoots. Attempts at mechanical inoculation gave negative results.

Leaf scald [*Bact. albilineans*: loc. cit.] was somewhat more prevalent in north Queensland following the more extended planting of the gumming resistant variety Oramboo, and farmers are advised to exercise more care in cutting plants. In resistance trials in the Mulgrave area, the percentages of infected stools produced from sett inoculation with leaf scald were 92 in H.Q. 426, 75 in Mahona (N.G. 22), 45 in H.Q. 409, 42 in Badila, 36 in Oramboo, 17 in Cato, 12 in Q. 29, 7 in D. 1135, 6 in Jason, and 5 in *Erianthus*.

A few stools infected with dwarf disease [ibid., xviii, p. 274] were found on four farms in the Mackay district, where the disease does not normally occur.

Sartoris (G. B.). **Necrotic stripes in Sugarcane.**—*J. Hered.*, xxxi, 12, pp. 515–520, 4 figs., 1940.

The dark brown stripes on the green backgrounds of the stalks and leaves of Striped Uba sugar-cane (*Saccharum sinense*), which was

imported into the United States from Natal in 1935, and has since been grown at Arlington Farm, Virginia, and Canal Point, Florida, were found to be composed of necrotic tissue. This is bacteriologically sterile, and for the time being the condition can only be attributed to a somatic mutation.

PADWICK (G. W.), MITRA (M.), & MEHTA (P. R.). **The genus Fusarium, IV. Infection and cross-infection tests with isolates from Cotton (Gossypium sp.), Pigeon pea (Cajanus cajan) and Sunn-hemp (Crotalaria juncea).**—*Indian J. agric. Sci.*, x, 5, pp. 707–715, 2 pl., 1940.

With a view to reconciling the conflicting evidence regarding the ability of the species of *Fusarium* isolated from cotton, pigeon pea, and *Crotalaria juncea* to pass from one host to another and cause infection [*R.A.M.*, xviii, p. 501; cf. also ibid., xx, p. 82], the writer carried out isolation and cross-inoculation experiments with 51 isolates from all three hosts, the results of which are tabulated and discussed.

Only one of the 16 cotton isolates caused wilting, but a number of them prevented normal germination of one or more of the three hosts. For instance, F 140 practically inhibited the germination of cotton and pigeon pea, F 142 exerted a very adverse effect on cotton and *C. juncea* but not on pigeon pea, while F 153 was detrimental to all three. None of these cotton isolates appeared to be capable of causing wilt at a later stage in the development of the plants. Owing to the appearance of a certain number of wilted plants in the controls, only a minimum of ten wilted plants was accepted as a reliable index of pathogenicity. On this basis the results clearly showed that most of the wilt-producing strains are almost if not entirely restricted to the original host, except that F 13 and F 15, isolated from *C. juncea*, induced wilting of pigeon pea, possibly because these isolations were made before the technique had been perfected and may have come from the superificial cortical tissue. It is of interest to note that the most severely pathogenic isolates made only poor or moderate growth on the mixture of soil and maize meal used as inoculum, whereas the relatively innocuous strains ramified in the substratum and produced considerable aerial mycelium.

BONDARTZEVA-MONTEVERDE (Mme V. N.) & VASSILIEVSKY (N. I.). К биологии и морфологии некоторых видов **Ascochyta** на бобовых. [A contribution to the biology and morphology of some species of *Ascochyta* on Leguminosae.]—*Acta Inst. bot. Acad. Sci. U.R.S.S., 1938*, Ser. II (Pl. Crypt.), pp. 345–376, 20 figs., 1940. [English summary.]

Artificial infection experiments carried out from 1930 to 1932 at the Botanical Institute of the U.S.S.R. Academy of Sciences, showed that among the species of *Ascochyta* parasitic on Leguminosae there are some specialized on one host, and others capable of infecting many. To the former group belong *A. fabae* on broad beans (*Vicia faba*), *A. pisi* on peas [*R.A.M.*, xvii, p. 427], *A. rabiei* on *Cicer arietinum* [ibid., xviii, p. 86], *A. lentis* n.sp. [with a Latin diagnosis] on lentils, and *A. onobrychidis* n.sp. [with a Latin diagnosis] on sainfoin (*Onobrychis sativa*), all of which produce severe infection only on their

respective common hosts and merely traces of infection on other plants. Furthermore, all these species are separated on the basis of their behaviour in pure culture.

*A. fabae* was more ready to form aerial mycelium in the first transfers, showed olive-green patches in the mycelium, and formed noticeably larger brownish pycnidia and larger conidia than *A. pisi*, the average size of the conidia on oat agar being 18·6 by 4·5 $\mu$ in *A. fabae* and 13·3 by 4·1 $\mu$ in *A. pisi*. The growth of *A. rabiei* on oat agar differed entirely from that of the other species of this genus, its pycnidia emitting a characteristic pink slime, which in some places coalesced to form a continuous pink mass. *A. lentis* is described as causing small, round, whitish lesions, 0·1 to 0·4 cm. in width, with an indefinite or narrow, brownish margin on the leaves and fruits of lentils, involving considerable losses to the crop, especially in the Ukraine. The pycnidia are generally gregarious, immersed, depressed-globose, 175 to 300 $\mu$ in diameter, with a minute, round ostiole, and with a yellowish-brown pseudoparenchymatous context. The conidia are cylindrical, straight or rarely curved, rounded at the ends, with a median septum, 11·5 to 19·5 by 3·5 to 5·8 $\mu$. On oat agar the fungus produced numerous dark pycnidia with dark brick-coloured exudate, forming abundant slightly pinkish aerial mycelium only after repeated transfers, and, as a further difference from *A. pisi*, coloured the substratum dark purple. In culture the conidia measured 13·5 to 17 by 4 to 5·7 (average 14·9 by 4·7) $\mu$. *A. onobrychidis*, collected in the Ukraine and the Caucasus, is stated to attack mainly the stems, on which it produces elongated, ochraceous or brownish lesions with a narrow, dark margin; on the leaves the spots are usually small, more or less rounded, ochraceous, with a narrow, dark brown margin. The pycnidia on the stems may be scattered, densely aggregated, or even sometimes coalescent, depressed-globose, dark brown to black, and slightly prominent, 115 to 120 $\mu$ in diameter, with an ostiole 20 to 30 $\mu$ in diameter; on the leaves they are light brown, sparse, immersed, and measure 115 to 250 $\mu$ in diameter. The conidia are cylindrical, with rounded ends, usually uni- but sometimes bi- or triseptate, not at all or slightly constricted, 13·5 to 20 by 4·5 to 6 (average 17 by 5·2) $\mu$. In pure culture the fungus on the whole resembled *A. pisi*, but was more ready to form aerial mycelium and produced noticeably larger pycnidia, the conidia on oat agar measuring on an average 15·4 by 4·9 $\mu$. *A. orobi* Sacc. var. *onobrychidis* Prill. & Delacr. is cited as a synonym.

The plurivorous group was represented by *A. phaseolorum*, which produced only slight infection both on its common host, beans (*Phaseolus vulgaris*), and on a number of other leguminous plants as well as *Lapsana communis*, belonging to the Compositae; *A. medicaginis* Fuck. [ibid., xviii, p. 320], thought to be a synonym of *A. imperfecta* [ibid., xvii, p. 13], to which several species of *Medicago* were susceptible; a species of *Ascochyta* on *Orobus vernus* (not yet named pending further studies) which also infects clover, although both only slightly; and probably *A. sojaecola* [ibid., xi, p. 88]. An intermediate position with regard to host specialization was occupied by *Didymella* [*Mycosphaerella*] *pinodes* with its conidial stage *A. pinodes*), which infected a number of leguminous plants slightly, but peas more severely than does *A. pisi*, the

latter also undergoing a longer incubation period in the host. The descriptions of all species studied are illustrated by drawings of the spores.

Nikolaeva (Mme T. L.). К монографии некоторых ро́дов из сем. **Polyporaceae** европейской части Союза и Кавказа **(Trametes, Daedalea, Lenzites).** [A contribution to a monograph of some genera of the family of Polyporaceae from the European part of the Union and the Caucasus (*Trametes, Daedalea, Lenzites*).]—*Acta Inst. bot. Acad. Sci. U.R.S.S., 1938*, Ser. II (Pl. Crypt.), pp. 377–431, 42 figs., 1 diag., 1940. [German summary.]

This is a list, with a key and extensive critical notes, of 25 species of *Trametes*, 4 of *Daedalea*, and 5 of *Lenzites*, including some new varieties and forms, based on material from the Leningrad herbaria collected in the European part of the U.S.S.R. and the Caucasus.

Tranzschel (V. G.). К биологии ржавчинных грибов Дальневосточного края. [On the biology of rust fungi from the Far East.]—*Acta Inst. bot. Acad. Sci. U.R.S.S., 1938*, Ser. II (Pl. Crypt.), pp. 323–344, 1940. [German summary.]

This list of 27 species of rusts, including four new to science and one re-named, is based on material collected by the author in 1927 and 1929 in the southern parts of the Far Eastern region of the U.S.S.R.

Cummins (G. B.). **New rusts from America and Africa.**—*Bull. Torrey bot. Cl.*, lxviii, 1, pp. 43–48, 1941.

Seven of the eleven new rusts comprising this critically annotated list [with Latin diagnoses] were collected by F. C. Deighton in Sierra Leone; the unusual features of one of these involved the establishment of a new genus, *Ypsilospora* (Puccinaceae).

Mundkur (B. B.). **Some fungi from Afghanistan.**—*Kew Bull., 1940*, 7, pp. 285–288, 1941.

The following are among the fungi collected by the writer during a visit to Afghanistan in the summer of 1939: *Ustilaginoidea virens*, *Entyloma oryzae*, and *Helminthosporium oryzae* [*Ophiobolus miyabeanus*] on rice [*R.A.M.*, xix, p. 301], *Sphacelotheca sorghi* on *Sorghum halepense*, *Tilletia foetida* [syn. *T. foetens*] on wheat, *Aecidium mori* on mulberry (*Morus alba*) [ibid., xvii, p. 347], *Melampsora lini* on *Linum usitatissimum*, *Uromyces fabae* on peas, *Alternaria solani* and *Cercospora concors* [ibid., xix, p. 6] on potato, *H. teres* on barley [ibid., xvii, pp. 449, 514, 737], and *Septoria tritici* on wheat [ibid., xvii, p. 383].

Hotson (H. H.). **The genus Armillaria in western Washington.**—*Mycologia*, xxxii, 6, pp. 776–790, 3 figs., 1940.

In this account of 15 species of *Armillaria* found in western Washington the author gives a key incorporating a more or less complete description of each species. This is followed by a discussion of the individual species regarding synonymy, habitat, and matters of systematic interest. *A. mellea* is said to be very common around Puget Sound.

MAYOR (E.). **Notes mycologiques X.** [Mycological notes X.]—Reprinted from *Bull. Soc. neuchâtel. Sci. nat.*, lxiv, 19 pp., 1939. [Received April, 1941.]

The following items are selected from this further instalment of the author's mycological studies from 1936 to 1938 in the canton of Neuchâtel, Switzerland [cf. *R.A.M.*, xvi, p. 277]. *Erysiphe cichoracearum* was observed on lettuce leaves in September, 1938. Inoculation experiments with aecidia of *Coleosporium petasitis* from the needles of *Pinus montana* on *Petasites albus* resulted in the profuse development of uredospores on this host. The aecidial stage of *Milesia* [*Milesina*] *vogesiaca* was detected on *Abies alba* needles [ibid., xv, p. 469] in 1937, and its genetic relationship with the uredo phase of the same fungus on *Dryopteris aculeata* experimentally confirmed. Inoculation experiments with teleutospores of *Puccinia graminis* on *Mahonia* [*Berberis*] *aquifolium* gave consistently negative results, whereas abundant infection was obtained by the same means on barberry, *B. gagnepaini*, *B. polyantha*, *B. thunbergii*, *B. virescens*, and *B. wilsonae*.

CARRERA (C. M.). **El género 'Fusarium' en la República Argentina. Estudio y clasificación sistemática (segunda contribución).** [The genus *Fusarium* in the Argentine Republic. Study and systematic classification (second contribution).]—*Rev. argent. Agron.*, vii, 4, pp. 277–296, 12 figs., 1940.

This is a critically annotated list of twelve species of *Fusarium* occurring in the Argentine Republic, namely, *F. avenaceum*, isolated in the Chaco from cotton, and recently observed (for the first time) in Uruguay on *Lupinus albus*, *L. angustifolius*, and lentils; *F. equiseti* var. *bullatum* (new to the Argentine) has been isolated from *Chionaspis citri*, a new insect host; *F. reticulatum* [*R.A.M.*, x, pp. 242, 435], *F. sambucinum* var. *minus*, and *F. conglutinans* var. *citrinum* on Klein 11 flax, lucerne, and chilli (*Capsicum annuum*), respectively; *F. orthoceras* (first record for the Argentine) on nursery pines and *Ricinus* [*communis*] branches, the same fungus having also been detected a short time ago in Uruguay on *L. angustifolius* and lentils; *F. orthoceras* var. *longius*, described for the first time from Uruguay on flax; *F. oxysporum* and its var. *medicaginis* on lupin and lucerne, respectively, in Buenos Aires; *F. dianthi* on carnations (a new record for the Argentine); *F. vasinfectum* causing chilli wilt [ibid., xix, p. 676]; and *F. vasinfectum* f. 1 on cotton.

Lists are given of both the species of *Fusarium* and their respective hosts in the Argentine Republic.

DANA (B. F.). **Morphological and anatomical features of phyllody in varieties of Tomatoes and Beans.**—*Phytopathology*, xxxi, 2, pp. 168–175, 4 figs., 1941.

In the phylloid blossoms produced by tomato plants suffering from big bud in Oregon [*R.A.M.*, xx, p. 93] the carpels were often represented by simple leaflets adhering by their margins or fully separated. In beans (common [*Phaseolus vulgaris*], Lima [*P. lunatus*], and soy-beans) similarly affected, the phylloid ovary varied from an inflated, sac-like structure, through a marginal-veined leaf with marginal leaflets

replacing the ovules, to leaves of normal aspect. An extension of the axis between adjacent whorls of the phylloid flower developed in the absence of adhesion or union between the vascular traces supplying these organs. Common beans further showed secondary or accessory phylloid flowers, inflorescences with phylloid blossoms, and shoots produced by axis extension beyond the carpel of the primary flower. Vegetative modifications of the perianth were characteristic both of tomato and beans, members of the perianth whorls being represented in extreme cases by phylloid structures. The stamens failed to mature normally, but persisted and remained separate in the phylloid tomato flower.

WELLMAN (F. L.) & BLAISDELL (DOROTHY J.). **Pathogenic and cultural variation among single-spore isolates from strains of the Tomato-wilt Fusarium.**—*Phytopathology*, xxxi, 2, pp. 103–120, 1 fig., 1 diag., 1941.

The authors studied 2,031 monospore isolates of *Fusarium bulbigenum* var. *lycopersici* from 18 parent strains of the tomato wilt fungus [*R.A.M.*, xx, p. 91] at the Division of Fruit and Vegetable Crops and Diseases of the Bureau of Plant Industry, Beltsville, Maryland. The maximum degree of variation in cultural type and pathogenicity was observed in isolates derived from parents of a predominantly saltating character. With three exceptions, such variations tend in the direction from cultures with profuse aerial mycelium (the most highly pathogenic) to those with growth almost or entirely appressed to the surface and submerged in the agar or liquid (the least virulent). Cultural variations were not correlated with the spore-form of origin (micro-, macro-, or chlamydospores). The raised form of culture evidently constitutes the basic type, since it alone gave rise to all five classes of variants described in the previous instalment of these investigations [loc. cit.]. The isolation of single spores from sectors, and selection through successive generations of monospore isolations, resulted in the development of strains of the fungus with the characteristics referred to above.

MELCHERS (G.), SCHRAMM (G.), TRURNIT (H.), & FRIEDRICH-FREKSA (H.). **Biological, chemical, and electron-microscopical investigation of a mosaic virus from Tomatoes.**—*Biol. Zbl.*, lx, pp. 524–556, 1940. [Abs. in *Chem. Abstr.*, xxxv, 3, p. 772, 1941.]

A virus designated 'tomato mosaic Dahlem 1940' was isolated from naturally infected tomato plants [? at the Biological Institute, Dahlem, near Berlin]. It resembles the tobacco mosaic virus, but can be distinguished from the latter by biological tests. The mode of isolation and characters of the virus protein are described, and the differences between the new mosaic and that of tobacco enumerated.

SWINGLE (R. U.), TILFORD (P. E.), & IRISH (C. F.). **A transmissible mosaic of American Elm.**—Abs. in *Phytopathology*, xxxi, 1, p. 22, 1941.

A mottled-leaf condition, resembling a virus disease, of the American elm [*Ulmus americana*] was first observed near Cleveland, Ohio, in 1927, since when trees with similar symptoms have been seen in other parts of the same State and elsewhere in the east. As a rule, some leaves

on the affected trees are normal in size and texture, while others are abnormally large or small, stiff, and often distorted. The small leaves show a typical yellow and green mottling, accompanied by rugosity, and sometimes by a mild to moderate 'brooming' of the branches. The wood of diseased trees seems dry and is frequently brittle. So far, none of the diseased trees under observation has died, though a gradual decline in vigour is apparent from year to year, and an unsightly appearance is imparted by the thinning of foliage and death of the scattered branches. In June, 1940, 19 out of 22 healthy elms grafted with patches of diseased bark a year earlier showed typical mosaic symptoms [cf. *R.A.M.*, xiv, p. 462; xvii, p. 543].

RAY (W. W.). **A new host for Taphrina bacteriosperma.**—*Mycologia*, xxxii, 6, pp. 752–755, 2 figs., 1940.

*Taphrina bacteriosperma* is recorded for the first time on yellow birch (*Betula lutea*) in Canada, causing blister-like, yellow to yellowish-red lesions on the leaves. The asci of the fungus arise from the subcuticular mycelium, and are in most cases wider below than at the top though they may be nearly cylindrical, with rounded to slightly truncate apical and basic ends; they measure 38 to 65 by 14 to 17 $\mu$, the base occasionally attaining a width of 25 $\mu$. The spores are numerous, ellipsoidal, 3 to 7 by 1 to 2 $\mu$.

MILLER (P. W.). **Current investigations on the control of Walnut blight in Oregon.**—*Rep. Ore. St. hort. Soc., 1940*, pp. 135–139, 1941.

An attempt to reduce the incidence of walnut blight [*Bacterium juglandis*: *R.A.M.*, xx, p. 39] in Oregon by fertilization with ammonium nitrate, ammonium sulphate, ammonium phosphate, calcium nitrate, gypsum, and muriate of potash, used alone or in combination, was unsuccessful, the results indicating that fertilization has but little, if any, effect on the incidence of blight infection on the nuts.

Current field trials again confirmed the fact that copper oxalate compares favourably with Bordeaux mixture as regards efficiency [ibid., xviii, p. 423]. In one trial, three applications of copper oxalate containing 20 per cent. metallic copper (3 lb. to 100 gals.) plus a rosin emulsion sticker (1 pint to 100 gals.), applied at the early pre-bloom, late pre-bloom, and early post-bloom stages reduced the incidence of infected nuts from 50·6 to 3 per cent., while three applications of a 4–1–100 Bordeaux mixture plus a heavy oil emulsion (1 quart to 100 gals.), reduced it to 1·1 per cent. In none of the copper oxalate trials was any foliar injury observed. It is concluded from the results of seven years' experiments that copper oxalate is practically as effective under Oregon conditions as Bordeaux mixture, provided it is used at a sufficiently strong concentration and the applications properly timed and thorough. It has the further advantage of being non-injurious to foliage. Copper oxalate is, however, about twice as expensive at present as Bordeaux mixture, and its use cannot, for economic reasons, be recommended.

Red cuprous oxide caused no foliar injury, but proved less effective than either copper oxalate or Bordeaux mixture.

In conclusion, Bordeaux mixture 6–2–100 is recommended for general use, with the addition of a mineral oil (1 pint to 100 gals.) or oil emulsion

(1 quart to 100 gals.), to the pre-bloom sprays to reduce the severity of injury to the foliage. Alternatively, copper oxalate may be used where cost is a secondary consideration, at the rate of 4 lb. of the product containing 20 per cent. metallic copper or 3 lb. of that containing 40 per cent. to 100 gals.

TAYLOR-VINJE (MARY). **Studies in Ceratostomella montium.**—*Mycologia*, xxxii, 6, pp. 760–775, 30 figs., 1940.

In this paper the results are given of a cytological study of *Ceratostomella montium*, causing a blue stain in lodgepole pine (*Pinus contorta*) in Wyoming. A description of the fungus by Caroline Rumbold is stated to be in the press. The author states, *inter alia*, that at the time the ascospores reach their full size, or shortly before, the ascus wall disappears leaving the spores lying free in the perithecial cavity.

HUNGATE (R. E.). **Nitrogen content of sound and decayed coniferous woods and its relation to loss in weight during decay.**—*Bot. Gaz.*, cii, 2, pp. 382–392, 1940.

In an investigation in Texas of the fungous decay [unspecified] of conifers under natural conditions, it was found that the amount of nitrogen in *Pinus monticola* averages 0·048 per cent. of the dry weight of the sapwood and 0·031 per cent. of the heartwood. A comparison of the dry weight, specific gravity, and nitrogen content values in samples (about 6 to 8 in. long and containing both sapwood and heartwood) of sound and decayed western white pine (*P. monticola*), western hemlock (*Tsuga heterophylla*), western red cedar (*Thuja plicata*), and white fir (*Abies grandis*) showed no significant change in the total nitrogen content during decay, although in white fir the rotten sapwood showed slightly less and rotten heartwood slightly more nitrogen than the sound samples. The average specific gravity of both sapwood and heartwood was higher in sound samples than in rotten ones, the difference being smallest in *T. plicata*. The fruiting bodies of the fungi contain a larger percentage of nitrogen than is found in the wood and their presence is taken to demonstrate a capacity on the part of the fungi to transport nitrogen for some distance through the wood. The results of the present analyses indicated that soil nitrogen was not transferred as far as the points from which samples were taken. Comparison of the amount of wood lost through decay and maximum amount of nitrogen available show that the wood loss is 500 to 700 times as great as the total available nitrogen. The experiments of Findlay [*R.A.M.*, xiii, p. 485] and Schmitz and Kaufert [ibid., xvi, p. 358] with added nitrogen are considered to indicate that the nitrogen present is utilized more effectively during decay than is that added. The results also emphasized the extreme economy with which the nitrogen in the wood is utilized, and this may explain in part the great success of certain fungi in destroying wood.

GREEN (D. E.). **Hygiene in the war-time vegetable garden. I. II. III.**—*J.R. hort. Soc.*, lxvi, 1, pp. 28–33; 2, pp. 56–61; 3, pp. 91–96, 19 figs. (facing pp. iii, xv, 87), 1941.

The potato being of primary importance as a war-time vegetable,

simple directions are given for the recognition and control of a number of the diseases commonly affecting the crop in England. Popular notes are also given on the symptoms, mode of infection, and control of diseases of cabbages and related crops and peas.

HASKELL (R. J.) & BOSWELL (V. R.). **Disease-resistant varieties of vegetables for the home garden.**—*Leafl. U.S. Dep. Agric.* 203, 7 pp., 1940.

After making brief, general reference to the chief means of preventing fungal disease in vegetable garden crops (e.g., by the use of resistant varieties, clean seed, seed and soil disinfection, rotation, and spraying and dusting), the authors give brief popular notes on some of the principal diseases of asparagus, beans, cabbage, celery, cucumber, lettuce, muskmelon [*Cucumis melo*], potato, spinach, pumpkin [*Cucurbita pepo*], sweet corn, squash [*C. maxima*], and tomato, and specify the varieties resistant to them.

PURVIS (E. R.) & HANNA (W. J.). **Vegetable crops affected by boron deficiency in Eastern Virginia.**—*Bull. Va Truck Exp. Sta.* 105, pp. 1721–1742, 8 figs., 1 map, 1940.

Field and greenhouse experiments [which are described] carried out in eastern Virginia on the effect of boron deficiency on vegetable crops showed that at least 16 crops grown locally under field conditions are affected, the deficiency being evidenced by growth response to applied borax or by the appearance of malnutrition symptoms. The maximum safe applications of borax under the local conditions are as follows: 5 lb. per acre for cowpeas, cucumbers, snap beans [*Phaseolus vulgaris*], and strawberries, 20 lb. for celery, muskmelon, peas, potatoes, squash, and watermelon, 30 lb. for cabbage, carrot, collard, maize, eggplant, kale, lettuce, lima bean, okra, onion, chilli, radish, spinach, and sweet potato, and 50 lb. for beet, cauliflower, mustard, tomato, and turnip. On soils where any one crop is affected the authors recommend that borax should be applied at the rate of not over 10 lb. per acre for beet, carrot, cauliflower, celery, maize, eggplant, kale, lettuce, mustard, sweet peppers [*Capsicum annuum*], potato, sweet potato, radish, tomato, and turnip.

FRANK (A.). **Seed treatment just one phase of Cabbage black rot control.**—*Market Gr. J.*, lxviii, 1, pp. 22–23, 1941.

Even chemically treated cabbage seed sown in virgin soil has been observed to suffer from black rot [*Pseudomonas campestris*] in certain sections of the United States [*R.A.M.*, xviii, p. 565; xix, p. 250, *et passim*], the pathogen being conveyed to fresh sites by means of insects (aphids may travel for a distance of two to three miles), wind, rain water wash, or irrigation water. Kitchen-garden and volunteer plants near commercial fields may also serve to tide the bacterium over the summer months and act as sources of fresh infection for autumn plantings. Seed from the Puget Sound (Washington) region may safely be sown without treatment, according to J. C. Walker (*Fmrs' Bull. U.S. Dep. Agric.* 1439, p. 18) and F. D. Heald (*in litt.*), but all other stocks should be disinfected by three minutes' immersion in 1 in 1,000 mercuric chloride.

DENNIS (R. W. G.). **Dry rot of Swedes. The importance of seed-borne infection.**—Reprinted from *Scot. Fmr, 1941,* 4 pp., 1 fig., 1941.

To determine how far a very low degree of infection of swede seed

by *Phoma lingam* [*R.A.M.*, xi, p. 345; xiii, p. 487; xix, pp. 70, 194] may be capable of initiating an outbreak of dry rot in the subsequent crop, the author in May, 1940, sowed Magnificent purple-topped swede seed bearing 1·02 per cent. infection and a small amount of Tipperary seed bearing 1·6 per cent. infection. The former was divided into four lots, one being treated on 1st May with agrosan G (2 oz. per bush.), one with ceresan at the same rate, one with hot water (122° F. for 20 minutes), and one remaining untreated; the latter was divided into two lots, hot-water-treated and untreated. The seed was sown in small plots of presumably clean land, and also in a swede field, in the latter case as part of the normal six-course rotation. The remainder of the field was occupied by an unnamed swede grown from uninfected seed.

On 6th August the mean amount of infection present in the large and small plots of Magnificent was: control, 1·4 per cent., agrosan-treated, 1·2 per cent., ceresan-treated, 0·08 per cent., hot-water-treated 0 per cent., Tipperary control 1·3 per cent. (the plot with Tipperary hot-water-treated seed was slow in brairding and was resown with ceresan-treated seed), ceresan-treated (field only), 0 per cent., hot-water-treated (small plot), 0 per cent.

Subsequent observations showed that where the seed-borne infection was eliminated by the hot-water treatment, the disease was almost completely controlled. Even at the end of October, it was still absent on the small hot-water-treated plots of both varieties; in the corresponding field plot of Magnificent 0·3 per cent. infection was present, probably mainly caused by spread from the contiguous, heavily infected agrosan plot.

The evidence is considered to indicate that under the conditions prevailing on the farm in question, soil-borne infection by *P. lingam* was negligible, any loss that occurred being directly due to seed-borne infection. Spread was considerably reduced by the dry conditions prevailing in 1940, so that a loss of 11·4 per cent. of the Magnificent crop as a result of 1·02 per cent. seed-borne infection may be regarded as a minimum, not a maximum, effect.

Control by seed dressings was only partly effective, probably owing to the varying degree to which the mycelium had penetrated the seed before treatment. However, ceresan dusting reduced loss at the end of October from 11·4 to 4·7 per cent. for Magnificent and from 3·8 to 1 per cent. for Tipperary seed.

Hot-water treatment seems to be the only truly effective method so far known of dealing with infected seed. The treatment is not easy to apply, owing to the narrow range of temperature which is both effective and safe, and the difficulty of drying the treated seed. If drying is not effected quickly, the treated seeds swell and lose the seed coats. The method cannot be recommended for use on a large scale by merchants and farmers.

The most suitable means of control of seed-borne infection would appear to lie in the production of healthy seed. As the amount of infection present in a seed sample can be reliably estimated in five weeks at most, it would appear to be desirable, where large stocks are involved, to make such a determination before placing the seed on the market, so that the most heavily infected samples may be discarded.

IMPERIAL MYCOLOGICAL INSTITUTE

# REVIEW
OF
# APPLIED MYCOLOGY

VOL. XX JUNE 1941

McNEW (G. L.). **Effect of seed treatment on the stand and yield of Peas.**—*Canner*, xcii, 6, pp. 56, 58, 60, 62; xcii, 7, pp. 16, 18, 20, 2 figs., 1941.

Most of the canning companies in New York are stated to treat pea seed with red copper oxide [*R.A.M.*, xix, p. 257] as a protective measure against attacks by soil-inhabiting fungi (*Pythium ultimum* and other species). The total cost of the treatment (graphite being added to the red copper oxide to facilitate drilling of the seed) is only about 45 cents per acre (for 4½ bush. of seed) and is considered to pay for itself if it prevents a complete failure of stand in one field out of 90, or saves 2·2 per cent. of the seed from decay.

In view of the conflicting results obtained with the treatment of peas in various localities, and because red copper oxide is known to be injurious to some varieties, 15 field trials, following preliminary greenhouse and laboratory tests, were carried out in the spring of 1940 with the varieties Surprise, Pride, Green Admiral, Wisconsin Early Sweet, Rogers Ace, Rogers Climax, and Rogers Famous. The seed, supplied by the canning companies from their regular stock, was treated with various chemicals, namely cuprocide (red copper oxide), spergon (a new fungicide), and semesan at the rate of 2½ oz. per bush., 2 per cent. ceresan at 2 oz., and new improved ceresan at 1 oz. per bush. in a rotating barrel churn for five minutes and then distributed to farmers. The results showed that the late varieties Pride and Green Admiral were more subject to decay than Surprise and are, therefore, as much in need of treatment as the early ones. The following conclusions are drawn from the data obtained. The treatment with cuprocide and graphite is very effective, but may under some conditions cause slight injury to the plant. It is, however, the least expensive of the treatments tested and where it has proved satisfactory before, its use may be continued. Of the organic mercury compounds tested, 2 per cent. ceresan, although not quite as effective as red copper oxide, is probably the most practical to use, semesan being very effective but too expensive. Both mercurials need the addition of graphite. New improved ceresan proved too injurious to plants and should not be used. To reduce the rate of its application would be of little use, since even at 1 oz. per bush. it was never as effective as cuprocide and spergon. This latter material offered distinct promise, being absolutely non-injurious to all pea varieties tested and safe on all soils with reaction

between $P_H$ 6·1 and 7·8. Yield records showed that spergon gave an increase in production regardless of whether seed decay was severe or not. Its price is rather high at present, but it is hoped that it will be reduced as soon as its production on a commercial scale is started.

ALFARO (A.) & SILVAN (A.). **La 'tabaquera' de las Judias.** ['Snuff' of French Beans.]—*Bol. Pat. veg. Ent. agríc., Madr.*, ix, 35–38, pp. 9–20, 11 figs., 1940.

During 1935 the authors commenced a study of bean [*Phaseolus vulgaris*] blight (known locally in Saragossa as 'snuff'), caused by *Bacterium phaseoli*, this being apparently the first true record of the disease for Spain. The causal organism is distinguishable from *Phytomonas* [*Bact.*] *medicaginis* var. *phaseolicola* (already reported for the country but originally confused with *Bact. phaseoli* [*R.A.M.*, xv, p. 765; xvii, p. 720]) by its capacity to liquefy gelatine and decompose starch. The symptoms of the disease, the morphological and cultural characters of its agent, and the mode of infection are described, and control measures based on crop rotation, the development of resistant varieties, use of clean seed, and destruction of contaminated refuse are briefly discussed.

BEATTIE (W. R.). **Lettuce growing.**—*Fmrs' Bull. U.S. Dep. Agric.* 1609, 29 pp., 20 figs., 1940.

On pp. 22–23 of this bulletin an account is given of the diseases commonly affecting the lettuce crop in the United States. Tipburn [*R.A.M.*, xix, p. 328] is regarded as a non-parasitic disease, developing during warm weather, especially when warm, bright days follow periods of fog or rain. The disorder is much reduced by good cultural methods and in particular by providing proper soil moisture in irrigated regions. Simple tipburn is characterized by brown, dead areas free from decay, along the leaf margin, but secondary organisms often cause a soft rot. Downy mildew [*Bremia lactucae*: ibid., xix, p. 577] is widespread, but in the eastern States is troublesome only under greenhouse conditions. There are marked varietal differences in susceptibility, and crossing the better commercial types with highly resistant varieties has increased the resistance of the former. The problem is rendered more difficult by the existence of different physiologic races of the fungus [loc. cit.]. The disease also affects wild lettuce, which should be eradicated from the vicinity of lettuce fields and greenhouses. Crop rotation is recommended, and applications of Bordeaux mixture made while the plants are young [cf. ibid., xviii, p. 155] keep the disease in check and may considerably reduce injury to the crop.

Notes are also given on lettuce drop [*Sclerotinia sclerotiorum*: ibid., xvii, p. 290], brown blight [ibid., xix, p. 324], to which several strains of the New York type of lettuce are resistant, and damping-off [ibid., xvii, pp. 365, 502; xix, p. 519].

UPPAL (B. N.), VARMA (P. M.), & CAPOOR (S. P.). **Yellow mosaic of Bhendi.**—*Curr. Sci.*, ix, 5, pp. 227–228, 1 fig., 1940.

Yellow mosaic of bhendi (*Hibiscus esculentus*) is stated to be widespread in the Poona district of India, where it seriously affects fruit production The first perceptible symptom is clearing of the small

veins, and then of the larger ones, the ill-defined, yellowish-green to pale yellow areas later extending into the mesophyll. In severely diseased plants, the young leaves develop a generalized chlorosis rather than actual mosaic patterns. All growth produced subsequent to infection is stunted, the leaves being under-sized and the petioles abnormally short. Flowering is sparse and few fruits are formed. Thickening of the veins on the lower leaf surface is a feature of the disorder in the greenhouse.

The virus of yellow mosaic is neither sap- nor seed-transmissible, but it is readily conveyed by grafting from diseased to healthy plants, and was further experimentally transferred by *Bemisia gossypiperda* from *H. esculentus* to hollyhocks and back to the original host, but not to Sakel cotton.

WHEELER (D. P.). **Black mildew or Spanish measles.**—*Calif. Cultiv.*, lxxxvii, 6, p. 180, 1940. [Abs. in *Biol. Abstr.*, xv, 1, pp. 138–139, 1941.]

Black mildew or Spanish measles (the former name being regarded as the more appropriate), due to an undetermined wood-rotting fungus, is considered to be the most serious grape disease in the San Joaquin Valley of California, where most vineyards sustain an average loss of 5 and a maximum of 10 to 15 per cent. of the fruit, accompanied by decline in vigour and sometimes by the death of the vines. The foliar symptoms are reddening, russeting, or desiccation, while the fruit is under-sized and may crack or shrivel. Control may be effected by spraying the dormant vines immediately after pruning with sodium arsenite at the rate of 3 lb. per 50 gals., supplemented by timely fertilizing (including the addition of minor elements), moderate pruning, and frequent but shallow irrigation.

PADWICK (G. W.) & UPPAL (B. N.). **The problem of inter-provincial plant quarantines in India.**—*Indian J. agric. Sci.*, x, 5, pp. 697–706, 1940.

Six categories of Indian crops may be differentiated for quarantine purposes, viz., (1) the staple foodstuffs (grains and pulses), grown mainly in the northern plains and southern lowlands; (2) the subtropical and tropical fruits, with a similar distribution; (3) commercial crops cultivated over a limited area, e.g., jute, tea, and coffee; (4) industrial crops grown on a wide scale, such as cotton, tobacco, and sugar-cane; (5) temperate fruit crops grown in the hills; and (6) temperate vegetables in widespread cultivation—in the hills in warm weather and on the plains during the cold season. A perusal of various relevant publications relating to India has yielded information concerning 68 diseases of such important crops [a tabulated list of which is given]; in 33 instances the causal organisms are distributed throughout the country, while a further 14 at least may be found within the narrow geographical confines of the particular host involved.

The problem of the enforcement of quarantine measures has been considered under various aspects, taking as a basis the principles accepted by the National Plant Board of the United States, i.e., (1) the pest against which action is proposed must jeopardize substantial

interests; (2) no better substitute for quarantine can be devised; (3) reasonable prospects of the success of the measure must exist; and (4) the economic gains must outweigh the administrative costs. In the light of these provisions, the several crop categories have been individually studied from the standpoint of the five types of quarantine action recognized by McCubbin [*R.A.M.*, xvi, p. 223], namely, embargo, detention, disinfection, inspection, and unrestricted entry, and the conclusion has been drawn that the only strong case for inter-provincial quarantine under existing conditions in India is that of the temperate fruit crops of the hills, though the quarantining of propagating material may be advisable against banana bunchy top, recently suspected in two places in India [ibid., xix, p. 584], and rubber mildew (*Oidium heveae*).

**Sixty-fifth Annual Report of the Ontario Agricultural College and Experimental Farm, 1939.**—69 pp., 1940. [Received February, 1941.]

The following items of phytopathological interest occur in various sections of this report. As in previous years, the Erban variety of oats showed marked resistance to loose and covered smuts [*Ustilago avenae* and *U. kolleri*], similar reactions also being manifested by Ripon, Banner (purified), and Bannock. Erban is likewise resistant to leaf [crown] rust [*Puccinia coronata*].

During the period under review *Phytophthora cactorum* destroyed nearly all the fruits on the lower trusses of two glass-house tomato crops. The spread of the fungus was arrested by keeping the water off the fruit and removing some of the lower leaves to admit sunlight and air.

Mould growth in cheese was experimentally shown to be controllable for a fortnight at temperatures up to 50° F. by 30 seconds' immersion of the cut slices in a 10 per cent. solution of calcium propionate [*R.A.M.*, xx, p. 173].

**Divisions of Plant Pathology and Seed Investigations.**—*Rep. N.Y. St. agric. Exp. Sta., 1939–40*, pp. 23–28, 37–42, 1941.

In tests of Bordeaux mixture ($1\frac{1}{2}$–9–100) and other copper-containing preparations used for spraying apple trees [against scab: *Venturia inaequalis*: *R.A.M.*, xix, p. 199], a high lime content in the former was again found to be absolutely essential for the avoidance of injury. Two lb. hydrated lime for each $\frac{1}{4}$ lb. actual copper in the insoluble coppers gave a marked decrease of injury over 1 lb. in the first cover spray, a reduction to 1 lb. being permissible in subsequent treatments. The copper silicates were the safest of the materials tested and the basic copper sulphates the most hazardous, at any rate for the first cover, the copper oxychlorides being intermediate in this respect. The particle size of coppers was found to be an important factor in the occurrence of spray injury, which was reduced to a minimum without sacrifice of efficiency by the use of brands with an average particle size of 10 $\mu$.

Complete elimination of peach leaf curl (*Exoascus* [*Taphrina*] *deformans*) was obtained by spring applications of Bordeaux mixture

($1\frac{1}{2}$–$1\frac{1}{2}$–100), lime-sulphur (3–100), or 0·5 per cent. elgetol [ibid., xx, p. 212].

The yellow-red virus or X-disease of peaches [ibid., xx, p. 213] is stated to be well established in New York State on its wild host, *Prunus virginiana*, the eradication of which for a radius of 500 ft. from healthy peach orchards appears to be the only means of combating the disease. Total destruction of the wild host of the virus was accomplished by spraying the leaves in July with sodium chlorate at the rate of 75 lb. per 100 gals. water.

Young sweet cherry trees sustained exceptionally heavy damage from the cankers associated with *Phytomonas* [*Pseudomonas*] *cerasi* [ibid., xviii, p. 689], the green fluorescent bacteria isolated from the margins of the lesions producing typical symptoms on inoculation into healthy young trees in the spring or autumn.

The past two years' observations have shown that the eradication methods for raspberry mosaic control practised in the Hudson Valley are not usually successful, while elsewhere in the State the efficacy of roguing depends on the relative freedom of the plantings from the insect vector of the virus, *Amphorophora rubi* [ibid., xviii, p. 190], and the extent of the area under the Columbian variety in the vicinity. Out of 67 red raspberry varieties and seedlings tested for resistance to mosaic, Marcy, Indian Summer, and 34 seedlings have remained free from the disease.

Spur blight of raspberries (*Didymella applanata*) does not ordinarily assume a serious form until a planting is four or five years old. Excellent results were obtained during the past season by thorough spraying of the canes in the green-tip stage with 1 per cent. elgetol or 1 in 8 lime-sulphur.

*Verticillium albo-atrum* in red, black, and purple raspberries has been effectively combated over a two-year period by the systematic roguing of diseased plants.

Bean [*Phaseolus vulgaris*] mosaic was very severe in the west of the State in 1939, practically every individual being diseased in sections planted with susceptible varieties, such as Stringless Green Refugee [ibid., xix, p. 450], which in five fields under observation yielded only 2·45 tons per acre compared with 3·94 and 3·84 for the resistant U.S. No. 5 Refugee and Idaho Refugee, respectively.

Bordeaux mixture (4–4–50) was the most effective of the preparations tested for the prevention of tomato leaf blight [*Septoria lycopersici*], but it caused some retardation of growth in the early sprays: this defect being absent from some of the fixed copper compounds [ibid., xx, p. 181], they (especially cuprocide 54–7) are being recommended as substitutes for application at this stage.

The fungi most commonly associated with root rot of peas were *Fusarium solani* var. *martii* f. 2, *F. oxysporum* f. 8 [ibid., xviii, p. 777], *Aphanomyces euteiches* [ibid., xx, p. 211], *Rhizoctonia* [*Corticium*] *solani*, and *Ascochyta* [*Mycosphaerella*] *pinodes*. Foot rot of the same host is chiefly associated with *F. solani* var. *martii* f. 2, while *F. oxysporum* f. 8 is also prevalent in warm, dry seasons, such as that of 1939–40; the following species, commonly isolated from the older diseased tissues of the foot and root, are apparently saprophytic under normal conditions:

*F. anguioides*, *F. equiseti*, *F. scirpi* var. *acuminatum*, *F. arthrosporioides*, *F. poae*, *F. sporotrichoides*, and *F. culmorum*.

Field tests and epidemiological studies, covering a five-year period, on hop downy mildew [*Pseudoperonospora humuli*] have shown that the oospores of the fungus are the principal, if not the sole, means of overwintering. The critical time for protection extends from the first appearance of the flower buds to the end of the burr stage; the initial spray application should coincide with the establishment of the pathogen on the plants about 5 ft. above soil-level.

The efficacy of sulphur against powdery mildew of hops [*Sphaerotheca humuli*], the existence of physiologic races of which is suspected, depends on its application, in dry or liquid form, before the appearance of foliar infection. Eradicant or curative sprays are necessary for the arrest of epidemics.

**Botany and plant pathology.**—*Rep. Ohio agric. Exp. Sta., 1937–8* (*Bull.* 600), pp. 20–25, 3 figs., 1939. [Received March, 1941.]

In this report [cf. *R.A.M.*, xviii, p. 785], it is stated that during the period under review apple leaves from trees in Ohio sprayed with lime-sulphur and flotation sulphur when measured early in July showed, respectively, 25 and 5 per cent. reduction in leaf area, as compared with the unsprayed controls. Leaf stunting due to lime-sulphur, when taken in conjunction with visible injury due to the treatment, must be regarded as serious, especially under adverse seasonal conditions, when fruit set, size, finish, and quality are all much impaired. The evidence from many tests indicates that only flotation sulphur is a satisfactory substitute for lime-sulphur against scab [*Venturia inaequalis*], the other wettable sulphurs failing to control infection during seasons favourable to it. A new spray schedule for apples [against *V. inaequalis*] is therefore suggested: lime-sulphur in the delayed dormant and pre-pink stages, and flotation sulphur paste subsequently, the quantities used being 12 lb. before bloom, 10 lb. at calyx, and 8 lb. subsequently, per 100 gals. of water. Flotation sulphur paste also controls frog eye [*Physalospora obtusa*: ibid., xvii, pp. 465, 688], but some form of copper is necessary for the control of bitter rot [*Glomerella cingulata*: ibid., xviii, p. 235] and blotch [*Phyllosticta solitaria*: ibid., xvii, p. 608].

Standard-strength lime-sulphur, applied to sour cherry trees against leaf spot [*Coccomyces hiemalis*: ibid., xix, p. 661] reduced leaf area by 40 per cent., and in the two seasons under review failed to control infection, though many of the fixed copper compounds gave effective control without producing stunting. The new schedule recommended is 3 lb. fixed copper (based on 25 per cent. metallic), 3 lb. hydrated lime, and water to make 100 gals. Three or four applications suffice. The results obtained in small-scale tests indicated that the same schedule is suitable for sweet cherries and plums.

Much progress was thought to have been made in the control of tomato leaf mould [*Cladosporium fulvum*: ibid., xix, p. 644] by the development of the resistant Globelle variety, until new strains of the fungus appeared [ibid., xix, p. 308], but an attempt is now in progress to sort out the strains and develop a generally resistant plant. The

disease causes heavy losses to spring and autumn crops, and has not proved controllable by spraying.

Considerable progress has been made in the control of pickle [cucumber] and melon wilt [*Erwinia tracheiphila*: ibid., xix, pp. 190, 694]. The use of a copper fungicide has been found to be very important, and a dust combination consisting of 12 lb. fixed copper (based on 25 per cent. metallic), 20 lb. flour, 5 lb. calcium arsenate, and talc sufficient to make 100 lb. has been widely adopted. It covers about twice as many vines per lb. as calcium arsenate-gypsum dust, has much better adhesive qualities, and necessitates fewer applications.

Transmissible lysins preventing or modifying bacterial growth have been found in decaying organic matter, as well as in extracts of viable seeds. Little doubt remains regarding the identity of the lytic factors, whatever their source, and the indications are that they may arise from an interaction between the bacterium and the invaded host tissue. If this can be proved, it will facilitate understanding of the mechanism of disease resistance in plants.

*Verticillium* wilt of chrysanthemums [ibid., xviii, p. 783; xx, p. 118] is becoming widespread and serious in Ohio, and certain very good varieties, such as those in the Seidowitz group, have fallen out of favour because of their susceptibility. Only healthy plants should be used for propagation. It is difficult to detect affected plants of some varieties in spring when cuttings are made, the symptoms being most obvious in the autumn at blossoming time, at which period roguing should be effected and only healthy plants retained for propagation. The number of infected plants has been reduced from 90 to under 20 per cent. in some varieties in a single season by this method. Of 300 varieties tested, 35 per cent. were resistant.

Careful pruning and application of 10–6–4 fertilizer will usually control *Verticillium* disease of elms and maples [ibid., xviii, p. 281; cf. also xx, p. 39].

HOFER (A. W.). **A characterization of Bacterium radiobacter (Beijerinck and van Delden) Löhnis.**—*J. Bact.*, xli, 2, pp. 193–224, 2 figs., 1941.

In order to clear up as far as possible the confusion surrounding the identity of *Bacterium radiobacter*, especially in regard to its relationship with *Phytomonas* [*Bact.*] *tumefaciens* and P. [*Bact.*] *rhizogenes* [*R.A.M.*, xix, p. 461], the author examined at the New York State Agricultural Experiment Station 51 cultures of the organism, of which three were supplied by the Iowa State College, six by the United States Department of Agriculture, and 42 by the University of Wisconsin.

*Bact. radiobacter* is indistinguishable by common cultural methods from *Rhizobium meliloti*, *R. trifolii*, *R. leguminosarum*, *R. phaseoli*, *Bact. tumefaciens*, and *Bact. rhizogenes*, but differential reactions occurred on certain media. The following features are peculiar to *Bact. radiobacter*: browning of mannitol-calcium glycerophosphate slants; turbidity of veal infusion broth, accompanied by heavy ring or pellicle production; raised, smooth, glistening colonies, each encircled by a halo, on nitrate glycerol agar; turbidity with pellicle on Clark and Lub's medium; pellicle after eight days at 50° C. on Koser's uric acid medium; good

growth on the ZoBell medium; and tolerance of strong alkalinity ($P_H$ 11 to 12).

The desirability of an amalgamation of *Bact. radiobacter*, *Bact. tumefaciens*, and *Bact. rhizogenes* with the closely allied *Rhizobium* species under observation is briefly discussed.

Van Lanen (J. M.), Baldwin (I. L.), & Riker (A. J.). **Comparisons of crown gall bacteria having normal, attenuated, and restored virulence.**—Abs. in *J. Bact.*, xli, 1, pp. 95–96, 1941.

It has previously been reported that several aliphatic amino-acids containing single amino and carboxyl groups destroyed the virulence of crown gall [*Bacterium tumefaciens*], the criterion of attenuation being the inability to induce galls in tomato stems. In recent studies at the University of Wisconsin cultures removed from amino-acid media immediately after attenuation soon recovered their pathogenicity, whereas those given additional transfers on amino-acid substrata did so slowly, or not at all, some in fact having remained avirulent for over four years, despite various attempts to accelerate the restoration of pathogenicity. This is believed to be the first instance in which a normal host constituent, with a definite formula, has been shown to possess the capacity for attenuation.

Fraser (J. G. C.). **The relative values of seed injured by rust, frost, or drought.**—*Sci. Agric.*, xxi, 6, pp. 307–314, 1941.

Eight lots of the 10 B strain of Marquis wheat, representing eight different kinds of physical properties in the kernels from plump and red, plump and piebald, to frosted, weathered, and rusted [infected by *Puccinia* spp.] were grown for three years in three different localities in Canada. In one area, significant differences were noted between the yield of the plump and red kernels and that of the rusted ones in two years; in the second area the plump and piebald kernels outyielded the rusted and frosted samples by significant differences of 0·3 and 2·8 bush. per acre, respectively; in the third locality, a significant difference resulted only once between plump red and plump piebald as compared with the rusted and frosted samples.

In experiments designed to ascertain the proper rate to sow rusted grain, plump seed and rusted seed were sown at rates of 75, 90, and 105 lb. per acre on farms at Brandon, Indian Head, and Ottawa. Significant differences were only noted at Indian Head in 1938 and at Ottawa in 1937; nevertheless even in tests in which a significant difference was not obtained there was a slight increase in yield as the rates of sowing increased in all the tests.

The data obtained indicate that plump seed is preferable to rusted and generally gives rather higher yields. If rusted seed is used, a much higher rate of sowing becomes necessary. While plump, well-matured, uniform grain of good germination is to be preferred for seed purposes to weathered, badly shrivelled, piebald, frosted, or rusted grain, yet, when germination and pedigree were satisfactory the difference in yield between the poorest and best quality seed in the three areas concerned was in no instance greater than 4·2, 2·6, and 4·7 bush. per acre, respectively.

PHILP (J.) & SELIM (A. G.). **Rust-resistant Wheats for Egypt.**—*Nature, Lond.*, cxlvii, 3720, p. 209, 1941.

All three wheat rusts [*Puccinia glumarum*, *P. graminis*, and *P. triticina*] are present in Egypt, the greatest loss of yield being produced by black rust [*P. graminis*] on [*Triticum*] *vulgare* wheats in the Nile Delta, where this loss appears to amount to not less than 10 per cent. of the possible yield, or about 2,500,000 bush. yearly. Barberry bushes do not occur in or near Egypt, and wheat plants are so seldom found in summer that they are not likely to carry over the rust. Air-borne spores of *P. graminis* have been found coming from the north-west, and this may, perhaps, be the chief source of infection.

Indian varieties of *T. vulgare* are more suitable for growing under Egyptian conditions than any other imported variety except Mentana; the Egyptian varieties of *T. vulgare*, known as Hindi wheats, are themselves of Indian origin. A moderately resistant *T. vulgare* variety, Mabrook, has been produced from Giza 7 (*T. vulgare*) × Beladi 42 (*T. pyramidale*), which gives about 17 per cent. higher yield than Hindis in the Delta, chiefly because of its seed size and weight.

Some Kenya wheats show promising resistance to *P. graminis* under Egyptian conditions, but are undesirable in other respects. Since 1936 these wheats have been crossed with Egyptian varieties, and some $F_4$ and $F_5$ lines have been obtained which are very resistant, high-yielding, and possess other desirable qualities. UX9M1A3 (Kenya) crossed with Giza 7 has given almost completely resistant lines. Giza 7, from Federation × Indian 7, is less susceptible than Hindis, and is the best quality Egyptian wheat. The Kenya parent, which is of unknown hybrid origin, is highly resistant, and has a gene for waxless foliage which is the dominant allelomorph of a gene for waxy, though waxy is generally dominant to waxless in *T. vulgare*. It may, therefore, originate from an interspecific cross, obtaining the dominant waxless and the rust resistance from the tetraploid parent. The evidence suggests that the physiologic races of *P. graminis* in Egypt may prove to be the same as those existing in India.

ALFARO (A.). **Una septoriosis del Trigo.** [A septoriosis of Wheat.]—*Bol. Pat. veg. Ent. agríc., Madr.*, ix, pp. 205–211, 4 figs., 1940.

Since 1936, wheat crops in the province of Saragossa, Spain, are stated to have sustained considerable damage from *Septoria nodorum*. The virulence of the fungus varies to a large extent with the date of onset of infection, early attacks on the nodes and glumes resulting in heavy losses, while a later and more generalized invasion is of little consequence. In one case observed by the writer dense infection by *S. nodorum* was accompanied by the presence of two other parasites, *Leptosphaeria herpotrichoides* and *Wojnowicia graminis*. The fungus grows most luxuriantly on potato agar, though bean, wheat flour, or oatmeal agars may also be used, producing on the first-named at 22° C. circular, radial, white, later olivaceous, filamentous, cottony colonies. A slightly acid ($P_H$ 6·2) reaction of the medium was found to favour growth. Pycnidia were formed most abundantly on wheat flour agar and failed to develop on the bean substratum. Inoculation experiments with aqueous pycnospore suspensions on potted wheat plants gave

positive results. The perfect stage of the organism was not obtained in culture, but among the pycnidia on the glumes, nodes, and leaves of naturally infected plants were encountered a few globose, black perithecia, 70 to 160 by 45 to 120 $\mu$ in diameter, furnished with a circular or elliptical ostiole, 22 to 30 $\mu$ in diameter, and containing numerous paraphysate, hyaline asci, rounded at the apex, each occupied by biseriate, fusiform, straight to slightly curved, hyaline, vacuolate, uniseptate ascospores, probably representing a species of *Leptosphaeria*, as held by G. F. Weber [*R.A.M.*, ii, p. 212], in opposition to Voglino, who believed the ascigerous form to be a *Sphaerella*. Further experiments are necessary, however, for the definite identification of the perfect stage of *S. nodorum*.

GARRETT (S. D.). **Soil conditions and the take-all disease of Wheat. VI. The effect of plant nutrition upon disease resistance.**—*Ann. appl. Biol.*, xxviii, 1, pp. 14–18, 1941.

In further experiments [the results of which are tabulated] on wheat take-all (*Ophiobolus* [*graminis*]) [*R.A.M.*, xix, p. 525] Red Marvel wheat plants were grown singly in sand culture in glass flower pots under conditions of full nutrient supply, and under deficiencies of nitrogen, phosphate, and potash, and of all three together, respectively. At the end of a month's growth the plants were inoculated with the fungus by the insertion of two pieces of infected wheat straw into the sand on each side of and just below the crown.

Root infection was lightest in the nitrogen-deficient, and heaviest in the potash-deficient, series. Percentage infection of the stem bases was lowest in the full nutrient and nitrogen-deficient plants and highest in the series deficient in all three nutrients. In the uninoculated controls a significant reduction in grain yield was produced only by phosphate deficiency, while in the inoculated plants deficiency of any of the three nutrients significantly reduced grain yield. Infection significantly reduced yield in every series except that given complete nutrients, percentage reduction being highest in the phosphate-deficient series. It is concluded that any nutrient deficiency, if great enough, may increase loss in yield through the disease.

BUDDIN (W.) & GARRETT (S. D.). **Seasonal occurrence of the take-all disease of Wheat.**—*Ann. appl. Biol.*, xxviii, 1, p. 74, 1941.

During 1940 wheat in England, apparently as a result of dry weather, showed little infection by take-all (*Ophiobolus graminis*). In many instances infection was present on the seminal roots and the lower parts of the crown roots, but had failed to progress to the crown. Thus, many wheat crops which appeared to be healthy and showed no whiteheads at harvest were carrying infection on the roots. The practice of risking a second crop of wheat after one apparently unaffected by the disease presents danger because a wheat crop that appears to be almost free from take-all at harvest may in reality be carrying sufficient infection on the roots to destroy a following winter wheat crop, if the soil and seasonal conditions favour an attack. One instance of such an occurrence in experimental crops in cages is cited.

HONECKER (L.). **Mehltauschäden bei Getreide und ihre Bekämpfung.** [Mildew damage to cereals and its control.]—*Mitt. Landw., Berl.*, lv, pp. 745–747, 1940. [Abs. in *Chem. Zbl.*, cxii (i), 2, p. 263, 1941.]

Summer barley in the neighbourhood of Weihenstephan, Bavaria, is stated to be readily infected by mildew [*Erysiphe graminis*] from winter crops in the vicinity. All environmental factors tending to disturb the balance between water uptake and transpiration of the plants, e.g., drying-out of the soil, sudden rises of temperature, and a habitat copiously enriched with nutrient salts, were found to enhance susceptibility to the disease, which was mitigated, but not effectively combated, by the observance of a rational fertilizing schedule. In the course of breeding experiments covering a 15-year period [*R.A.M.*, xvii, p. 807], a resistant summer variety has been successfully developed, which has already given proof of its superiority in regions where winter barley is extensively cultivated on a commercial scale.

HAYES (H. K.). **Breeding for resistance to crown rust, stem rust, smut, and desirable agronomic characters in crosses between Bond, Avena byzantina, and cultivated varieties of Avena sativa.**—*J. Amer. Soc. Agron.*, xxxiii, 2, pp. 164–173, 1 fig., 1941.

Continuation of investigations at Minnesota [*R.A.M.*, xix, p. 206] showed that it is relatively easy to combine the desirable characteristics of *sativa* oat varieties with the resistance of Bond oats to crown rust [*Puccinia coronata*], stem rust [*P. graminis avenae*], and smut [*Ustilago avenae* and *U. levis*]. Crosses with outstanding qualities of yield, resistance, and absence of lodging were obtained, and tested in thorough statistical field trials.

RADEMACHER (B.). **Über die Eignung des Mangans in Thomasmehl, Martinschlacke und Hochofenschlacke zur Behebung der Dörrflekkenkrankheit.** [On the suitability of the manganese in basic, Martin, and blast furnace slags for the control of grey speck disease.] —*Bodenk. u. PflErnähr.*, N.F., xix, pp. 166–187, 1940. [Abs. in *Chem. Zbl.*, cxi (ii), 22, p. 3088, 1940.]

In pot and field experiments on manganese-deficient soils at the Hohenheim Agricultural College, the assimilability of the manganese extracted from basic, Martin, and blast furnace slags was compared with manganese sulphate for the control of grey speck of oats [*R.A.M.*, xviii, p. 668; xix, p. 302]. The manganese in basic slag was taken up by the plants, but less effectively utilized than manganese sulphate. The element in this form may safely be used on soils tending to produce grey speck, and its efficacy can be increased by the simultaneous application of an acid fertilizer, such as ammonium sulphate. Manganese from the other two types of slag was also assimilated by the plants.

NILSSON (F.). **Rågförsök och Rågförädling vid Sveriges Utsädesföreningens Västernorrlandsfilial.** [Rye experiments and Rye breeding at the western Norrland branch of the Swedish Seed Association.]—*Sverig. Utsädesfören. Tidskr.*, l, 1, pp. 4–30, 1940.

This is a comprehensive, tabulated survey of a series of experiments, which has now been in progress for many years, on the adaptation of

different rye varieties to the prevailing environmental conditions in Norrland, Sweden, where the problem of winter injury by *Fusarium nivale* [*Calonectria graminicola*], *Typhula borealis* [*R.A.M.*, xvi, p. 802], and *Sclerotinia* [*borealis*: ibid., xviii, p. 298] is stated to be extremely acute. I. Gadd (*Medd. centr. Frökontrollanst., Stockh.*, 14, 1939) questions the existence of any inherent differences in the reaction of rye to *C. graminicola*, the main source of infection by which is believed to be the seed. However, in the writer's tests from 1932 to 1938, inclusive, in which all the seed was treated with uspulun, marked varietal divergences were observed in respect of susceptibility to snow mould, especially in 1935, 1936, and 1938, when the newly developed local Norrland types, the Finnish varieties Halola, Härmä, and Toivo, Sangaste (Estonian), and Alaska proved much more resistant than the southern-bred Improved Vasa I and II, Midsummer, Malmo, Petkus, and others. G. I. Tornquist's observations at Luleå in 1938 (*Sverig. Utsädesfören. Tidskr.*, xlix, 1939) also revealed marked varietal differences in the reaction of rye to the three above-mentioned fungi, of which *T. borealis* appears to have been the most harmful. Here again the varieties of southern origin, with their relatively poor vitality, failed to withstand disease as well as the hardier northern types.

Tzereteli (L. Y.) & Tchanturia (N. N.). Фитофтороз цитрусовых плодов. [*Phytophthora* on Citrus fruits.]—*Sovetsk. Subtrop.*, *1940*, 9, p. 44, 1940.

Brown rot of citrus, caused by *Phytophthora* sp. [*R.A.M.*, xviii, p. 671], first noticed in the Georgian S.S.R. in 1936, is stated to have been almost universally present in plantations of Abkhazia and Adzharia by 1939, inducing fruit drop in lemons, oranges, tangerines, grapefruit, and citrons.

Gogvadze (I. I.). Ветрозащитные полосы в борьбе с цитрусбластом. [Wind-breaks in the control of Citrus blast.]—*Sovetsk. Subtrop.*, *1940*, 9, p. 57, 1940.

Observations on citrus blast (*Bacterium* [*Pseudomonas*] *citriputeale*) [*R.A.M.*, xviii, p. 671] on the Tzikhis-Dzir, Akhalshensk, and Makhin-Dzhaur State farms, where 20,000 to 25,000 out of a total of 200,000 trees were affected, showed that all the diseased trees grew on sites unprotected from winds. In tests conducted in 1939 seven trees in a plantation of 1,221 were either wrapped in gauze or partially screened from wind leaving the top of the tree exposed. In the following spring all unprotected trees were found to have diseased twigs (on an average 45 to 95 twigs per tree), whereas the wrapped trees were entirely free from disease, and the screened trees had diseased twigs only in their exposed crown. It is concluded from these results that wind-breaks are an effective means of controlling blast and should be introduced into all citrus plantations.

Van Der Plank (J. E.) & Van Niekerk (O. T.). **Notes on the bleaching of sooty blotch from Oranges.**—*Citrus Grower*, *1940*, 83, pp. 1, 3, 1940.

The information presented in this note on the substitution of calcium

hypochlorite for a mixture of bleaching powder and sodium bicarbonate for the removal of sooty blotch (*Gloeodes pomigena*) from oranges in South Africa has already been noticed from another source [*R.A.M.*, xx, p. 200].

ROY (W. R.) & BAHRT (G. M.). **The effect of zinc, iron, manganese and magnesium, applied to frenched and bronzed Orange groves, on the vitamin C content of Oranges.**—*Proc. Fla hort. Soc.*, liii, pp. 34–38, 1940. [Abs. in *Chem. Abstr.*, xxxv, 4, p. 1168, 1941.]

The juice of oranges from 'frenched' and 'bronzed' [*R.A.M.*, xvii, pp. 520, 672] trees in Florida yielded a subnormal amount of ascorbic acid, but following the incorporation with the soil of zinc in the first instance and manganese in the second, the vitamin C content of the fruit gradually rose to its normal level. Similar applications of these and other elements to healthy trees failed to produce any comparable increase in the ascorbic acid content of the oranges.

HALMA (F. F.). **Bud-shoot wilt of Citrus nursery trees.**—*Calif. Citrogr.*, xxvi, 4, pp. 86, 106–107, 2 figs., 1941.

In 1930 the author's attention was drawn to a citrus nursery in Ventura county, California, in which about 20 per cent. of the young bud shoots wilted and died. The nursery consisted of lemon and Valencia orange budded on sweet and sour orange rootstock seedlings, and the Valencia bud shoots were affected to a much greater extent than the lemon. The majority of the affected shoots were under 6 in. in length. In some cases a new sprout took the place of the wilted one. Sometimes two shoots growing out simultaneously wilted, sprouts appearing at or near the base of the original shoot. On shoots over 6 in. long and on those whose basal portion was partly mature the wilt was confined to the upper growing part, which in time became replaced by lateral roots.

Observations on some 2,300 budded Valencia oranges showed that about 85 per cent. of the wilt that later developed occurred on shoots 6 in. or less in length. Nearly all produced a second sprout which did not wilt. No shoot over 18 in. long was affected. The percentage of total wilt was nearly twice as high for one budder as for another. Very little wilt occurred on buds tied with string but the percentage of dead buds was high. Other observations showed that sudden rises in temperature and probably desiccating winds were important factors conducing to the condition, which is more prevalent under arid interior than under coastal conditions.

It is assumed that wilt is entirely physiological in origin. In the case of inserted buds incomplete union of bud and rootstock tissues apparently prevents enough water from reaching the sprout to sustain it during sudden hot, dry spells, this view being supported by the fact that watersprouts on the rootstock stub do not wilt.

TURRELL (F. M.), SINCLAIR (W. B.), & BLISS (D. E.). **Structural and chemical factors in relation to fungus spoilage of Dates.**—*Rep. Date Grs' Inst., 1940*, pp. 5–11, 4 figs., 4 graphs, 1940.

Fruit spoilage [*R.A.M.*, xviii, p. 104], in which at least 20 species of

fungi and several forms of yeasts and bacteria are involved, is stated to be the most important group of date diseases in California. Unusually heavy losses of dates from this source, amounting to a reduction in tonnage from about 11,000,000 lb. to less than 4,000,000, have occurred in the Coachella Valley in 1939 as the result of two heavy rainstorms. It is estimated that roughly half the loss was caused by water injury and the other half by fungous decay. All the fungi known to cause spoilage in dates usually enter the rind of the fruits through ruptures caused by water injury, but are capable under favourable conditions of penetrating unwounded fruit surfaces. The present preliminary paper gives the results of a study of the problem begun in 1931 and is confined to a discussion of the two most important agents of spoilage, *Aspergillus niger* causing calyx-end rot, and *Alternaria* sp. (similar to *A. citri*) causing side spot decay on the Deglet Noor variety. The period of susceptibility of the dates to fungous attack falls mostly within the 'khalal' (turgid and red) and 'rutab' (partially softened to completely softened and reddish to brownish) stages of maturity, during which the moisture and sugar concentrations appear to be favourable to fungous growth; the preceding and following stages, 'kimri' (turgid and green) and 'tamar' (softened, brownish, and cured to a point where the fruit will keep), respectively, seemed unsuited for the development of the organisms concerned. An investigation of the causes preventing infection by the fungi in these stages of maturity shows that the fruit is provided with both structural and chemical types of protective mechanisms. In the case of calyx-end rot, *Aspergillus niger* attacks the unwounded fruit in the region of the calyx where the cuticle is absent and the outer epidermal wall not yet thickened, but is unable to penetrate the unwounded surface anywhere else owing to the presence of thickened cuticle and epiderm. The fungus made fair to good growth on media containing digallic acid, indicating that this type of tannin is not important in protecting date fruits from *A. niger*.

*Alternaria* sp. will attack wounded dates in the 'khalal' and 'rutab' stages, but direct penetration of unwounded fruits occurs only in the latter, the lesions, when first visible, being usually situated in the turgid, unripened portion of the fruit in any region between the tip and the calyx, but within a short distance of the advancing margin of the translucent tissue. The *Alternaria* is capable of penetrating the cuticle and fully differentiated epiderm, but in the 'rutab' stage of maturity there is a decrease in the concentration of tannin-like substances in the epiderm and hypoderm, which is correlated with loss of resistance to the fungus. In experiments with true tannin mycelial growth was markedly inhibited by digallic acid at a concentration of 1·25 per cent., and entirely arrested at one of 5 per cent. The protective mechanism here involved seems therefore to be chemical in nature. The resistance of dates in the 'tamar' stage to fungi in general is thought to be due to high osmotic pressure in the presence of an abundance of sugar in the sap of ripe fruit.

Bliss (D. E.) & Bream (R. O.). **Aeration as a factor in reducing fruit spoilage in Dates.**—*Rep. Date Grs' Inst., 1940*, pp. 11–15, 2 figs., 1940.

Further field experiments on the fruit spoilage of dates in California

[see preceding abstract], conducted during 1938–9 on 12- to 13- year-old Deglet Noor palms, confirmed previous conclusions that aeration is beneficial, especially during years with rainfall and high relative humidity during the period of maturity. The experimental bunches being all reduced to approximately the same size by thinning, wire rings were inserted into some of them at the late 'kimri' (green) stage of maturity, spreading the fruit strands apart so as to produce a circular opening of about 8 in. diameter in the centre of the fruit bunch. All bunches were covered with heavy, unwaxed, crepe paper bags, of which some were unbroken and others perforated with irregular holes. The fruit-ripening season in 1938 was practically free from rain, while that of 1939 was one of the wettest yet recorded, and consequently the loss from fruit spoilage in 1939 was at least 10 times greater than that in 1938. In both years bunches with wire rings had the least water injury while the unaerated bunches had the most. Black nose [*R.A.M.*, xviii, p. 104] ranged in 1938 from 1·1 per cent. in aerated to 5·5 per cent. in unaerated bunches, and in 1939 from between 1·7 to 2·5 per cent. in the former to between 4·6 to 7·2 per cent. in the latter. The small amount of fungous decay in 1938 was limited almost entirely to calyx-end rot caused by *Aspergillus* [*niger*] and *Penicillium*; in 1939 side spot decay due to *Alternaria* was very common and probably as destructive as calyx-end rot.

Admitting the beneficial effects of aeration, it is nevertheless concluded that the methods of controlling fruit spoilage in dates are still unsatisfactory. Perforation of the bags may be undesirable, as bunches in perforated bags seemed wetter than those in regular ones. The manufacture of wire rings is discussed and a machine for making crimped wire described. With experience in handling the wire, it is said to be possible to reduce the cost to less than 0·5 cent per ring.

KLEIN (A. V.). **La enfermedad del Café en el Oriente.** [The Coffee disease in the east.]—*Rev. agríc., Guatemala*, xvii, 10, p. 319, 1940.

Coffee in the vicinity of Lake Pino, Guatemala, is stated to suffer from a root rot and wilt caused by a Myxomycete, with a 'myxoflagellate' phase [cf. *Phytomonas leptovasorum*: *R.A.M.*, xiii, p. 28]. The pathogen migrates from the soil through the capillary roots into the interior of the conducting vessels and companion cells, destroying the cell walls. Within the cells of the woody portion of the root, the fungus is transformed into the 'myxamoeba' stage, in which further multiplication is effected by division. The passage of the parasite is obstructed and the organism being unable to thrive under these conditions, undergoes a further metamorphosis through the confluence of groups of myxamoebae into plasmodia, which become encysted and return by way of the slender roots to the soil, whence they are conveyed by various agencies, such as wind, water, insects, implements, and labourers, to healthy plants. Control measures should include the disinfection of the soil, for a distance of 2 m. round each eradicated bush, with 5 per cent. copper sulphate, and the use for propagation of grafts from bushes that have recovered from the disease and thus acquired immunity from future attacks.

KRUG (H.). **Cafés duros. I. II. Um estudo sôbre a qualidade dos Cafés de varrição. III. Relação entre procentagem de microorganismos e qualidade do Café.** [Hard Coffee berries. I. II. A study on the quality of fallen Coffee berries. III. Relation between the percentage of micro-organisms and the quality of the Coffee.]—*Rev. Inst. Café, S. Paulo*, xv, 159, pp. 636–638; 163, pp. 1393–1396; 165, pp. 1827–1831, 2 graphs, 1940. [English summaries of parts II and III.]

Coffee berries in São Paulo, Brazil, are harvested only once in the season, when ripe berries are plucked from the bushes, and those which have already fallen to the ground are also collected. The present study is concerned with the effect of micro-organisms on the flavour and quality of berries which were found to deteriorate progressively with the length of the time during which they have been lying on the ground, especially when showers fall on the drying product. *Fusarium concolor* was the fungus most frequently isolated from low-grade samples with a so-called 'hard' or 'Rio' taste, though others, as yet unidentified, were also implicated: in four lots with averages of 9·3, 23·4, 44·8, and 54·5 per cent. fungal infection, the average incidence of *F. concolor* was 3·4, 11·0, 23·0, and 34·5 per cent., respectively.

UPPAL (B. N.), KULKARNI (Y. S). & RANADIVE (J. D.). **Further studies in breeding for wilt resistance in Cotton. I. Isolation of wilt-resistant types. II. A preliminary note on the genetics of wilt resistance in Indian Cottons.**—*Proc. second Conf. sci. Res. Wkrs Cott. India*, 31 pp., [? 1940].

The fully tabulated data from experiments at Poona covering a wide range of cotton (*Gossypium herbaceum* and *G. arboreum* var. *neglectum*) strains show that continuous selfing and selection for resistance to wilt [*Fusarium vasinfectum*: *R.A.M.*, xix, p. 15] over a period of three to four years under conditions of infection approaching the optimum culminate in the development of types fully resistant (complete absence of leaf mottle) to the disease, the homozygous condition being reached more rapidly in some lines than in others. The attainment of full resistance in the strains and segregates of the B.D. 8 crosses, for instance, having been achieved by stages, is assumed to be attributable to the gradual elimination of minor modifying factors, a result easily accomplished in the specially chosen conditions of pot culture but difficult to effect in the field. It is emphasized, however, that field selection remains the only practicable method of 'building up' resistant types as a preliminary to their selection in pot culture under controlled glasshouse conditions. A number of Million Dollar cultures, having been entirely wilt-free during the last three seasons, may also now be classed as 100 per cent. resistant.

Evidence of monohybrid segregation for wilt resistance was secured in the $F_2$ generation of K.F. $\times$ 1027 A.L.F., whereas in crosses between Dhulia 2 and (1) Chinese $R_1$ spotless 51 and (2) New Million Dollar, this character was found to be governed by three complementary factors.

TALLEY (P. J.) & BLANK (L. M.). **A critical study of the nutritional requirements of Phymatotrichum omnivorum.**—*Plant Physiol.*, xvi, 1, pp. 1–18, 3 graphs, 1941.

A study of the nutritional requirements of *Phymatotrichum omnivorum*

in synthetic solutions showed that a proper balance between dibasic potassium phosphate and magnesium sulphate was as important as the direct effect of either salt. When such a balance was maintained, the concentrations of both could be decreased by 50 or increased by 400 per cent. without significant change in growth rate. In this balance the potassium ion was more important than the phosphate radical. The chloride ion was either inessential or was provided in adequate amounts as impurities in the reagents. There was no significantly superior combination of salts for the supply of the inorganic nutrients, the range of tolerance for the major essential ions being wide. A solution containing 0·008 M dibasic potassium phosphate, 0·003 M magnesium sulphate, 0·002 M potassium chloride, and 2 p.p.m. of iron, manganese, and zinc was not significantly improved by increasing or decreasing the concentration of any one of these salts or their ions. This solution is well balanced, and the amount of growth on it was governed by the nitrogen supply or the available carbon.

Growth rate increased with supply of ammonium nitrate over a certain range only, beyond which the growth increment rapidly fell. With very high concentrations of ammonium nitrate the responses to the different concentrations of dibasic potassium phosphate and magnesium sulphate were irregular. The greater growth rate given with higher concentrations of nitrogen did not increase the efficiency of carbon utilization. If glucose (the carbon source) is not a limiting factor, growth rate may be regulated by nitrogen supply, but if it is, little is gained by increasing the nitrogen supply. Increase in the carbon supply increased the amount of growth but reduced the apparent efficiency of carbon utilization.

Goetsch (W.) & Grüger (R.). **Die Pilze der Blattschneider-Ameisen und ihre Vernichtung.** [The fungi of leaf-mining ants and their destruction.]—*Naturwissenschaften*, xxviii, 49, pp. 764–765, 1940.

In a recent communication (*Biol. Zbl.*, xl, 1940) the first-named author (with R. Stoppel) reported the consistent isolation from the 'fungus gardens' of the Brazilian leaf-mining ant, *Atta sexdens*, of *Hypomyces ipomoeae* and *Fusarium* spp., while those of *Acromyrmex striatus* in Patagonia yielded closely related forms. In laboratory experiments at the Breslau Zoological Institute these organisms were presented to the insects, which utilized them repeatedly for the construction of new gardens, but only when accompanied by other fungi (especially *Mucor* spp.), as under natural conditions. In the meantime the Patagonian ants have further been induced to make use of *Hypomyces* spp. occurring on *Boletus* spp. in Silesia, again in conjunction with *Mucor*, so that the provision of specifically South American strains is evidently unnecessary. The addition of sugar juices to the fungal mycelium was found to increase the size of the broods produced by the ants. The *Hypomyces* and *Fusarium* spp. under observation throve best in the saliva secreted by the ants in the act of chewing the leaves, which was toxic, however, to ordinary moulds. The writers have now accomplished their object of breeding fungi antagonistic to the ant symbionts, which are overrun and destroyed by such fungi both in their natural habitat and in agar cultures. Furthermore, the insects

themselves conveyed the spores of the antagonistic fungi, strewn along the approaches to the nests, into the interior, where both the ants and their fungal symbionts perished in a few days.

CONANT (N. F.). **The taxonomy of the anascosporous yeast-like fungi.**—*Mycopathologia*, ii, 4, pp. 253–266, 1940. [Received April, 1941.]

In the first part of this paper, a preliminary account of which has already been noticed [*R.A.M.*, xix, p. 555], the author briefly reviews the results [as yet unpublished] obtained by Martin and Jones from a study of 461 strains [including the 153 already reported on: ibid., xvi, p. 811] of anascosporogenous yeasts. Langeron and Guerra [ibid., xviii, p. 253] recognized 16 species of *Candida*. Martin and Jones, who prefer to use the generic name *Monilia* reduce six of these to synonymy and regard *C. pelliculosa*, *C. zeylanoides*, *C. deformans*, and *C. suaveolens* as doubtful, thus leaving the following: *C. albicans* (syn. *C. triadis*, *C. aldoi*), *C. parakrusei* (syn. *C. chalmersi*, *C. lodderi*, *C. brumpti*, *C. flareri*), *C. parapsilosis*, *C. krusei*, *C. tropicalis* (*C. intermedia* [see also below]), *C. pseudotropicalis* (syn. *C. mortifera*), *C. stellatoidea*, and *C. guilliermondi*.

In the taxonomic discussion which follows it is pointed out that the synonymy of *M. candida* Bon. 1851 follows two courses: first, *M. candida* Bon. of Plaut 1887 equals *M. bonordenii* of Vuillemin 1911 equals *Candida albicans* of Berkhout 1923 and of Langeron and Guerra 1938 equals *Mycotorula albicans* of Ciferri, Redaelli, and Cavallero 1938; and second, *Monilia candida* Bon. of Hansen 1888 equals *Monilia tropicalis* of Castellani 1913 equals *Candida vulgaris* of Berkhout 1923 equals *Candida tropicalis* of Berkhout 1923.

The opinion that the yeast-like *M. candida* Bon. of Hansen, renamed *C. vulgaris* by Berkhout was identical with the original *M. candida* Bon. 1851 caused this fungus to become the type species of *Candida*, as it antedated *M. albicans* (Robin 1853) Zopf 1890. It is thought to be improbable, however, that any yeast-like fungus isolated since Bonorden's original description was identical with his *M. candida*. It is also considered very improbable that *M. candida* Bon. 1851 differed from *M. candida* Pers 1797–1822, as Bonorden based his genus *Monilia* on that of Hill-Fries. *M. candida* Bon. 1851 should therefore be regarded as an *Aspergillus* or a *nomen dubium*.

*M. albicans* (Robin) Zopf 1890 consequently becomes the earliest described species and should be the type of the genus. *M. tropicalis* Cast. 1913 would then replace *C. vulgaris* of Berkhout 1923 and include the following synonyms: *Monilia candida* of Hansen 1888, *Candida tropicalis* Berk. 1923, *Blastodendrion intermedium* Cif. 1929, *Geotrichoides vulgaris* Lang. & Talice 1932, *Candida intermedia* Lang. & Guerra 1938.

In conclusion, the claims of *Syringospora* as the valid name for the genus are again advocated.

MOORE (M.). **The chorio-allantoic membrane of the developing chick as a medium for the cultivation and histopathologic study of pathogenic fungi.**—*Amer. J. Path.*, xvii, 1, pp. 103–120, 3 pl., 1941.

Highly gratifying results have been obtained by the writer at the Barnard Free Skin and Cancer Hospital, St. Louis, Missouri, by the use

of the chorio-allantoic membrane of the developing chick as a culture medium for the following human pathogens [*R.A.M.*, xviii, p. 738], the growth characters of each of which are described in detail: *Malassezia furfur*, *Pityrosporum ovale*, *Trichophyton gypseum*, *Epidermophyton inguinale* [*E. floccosum*], *Achorion schoenleini*, *Microsporon canis*, *Monilia* [*Candida*] *albicans*, *Geotrichum versiforme* Moore, 1934, *Zymonema* [*Endomyces*] *dermatitidis*, *Cryptococcus hominis* or *C. histolyticus* [*Debaryomyces neoformans*], *Coccidioides immitis*, *Sporotrichum schenckii*, *Actinomyces bicolor*, *Monosporium* [*Microsporon*] *apiospermum*, and *Phialophora verrucosa*. The organisms in question made luxuriant growth and in most cases reverted to their parasitic morphology in 5 to 11 days. By this method, which is both less costly and more rapid than that involving the use of laboratory animals, it has been possible to develop lesions simulating those hitherto confined to human subjects.

LIVINGOOD (C. S.) & PILLSBURY (D. M.). **Ringworm of the scalp. Prolonged observation, family investigation, cultural and immunologic studies in 130 cases.**—*J. invest. Derm.*, iv, 1, pp. 43–57, 2 figs., 1941.

In a series of 130 cases (96 per cent. coloured) of ringworm of the scalp in a small district of Philadelphia *Microsporon audouini* was isolated in 125. Of the investigations reported in this paper it may be mentioned that the examination of giant cultures by fluorescent light proved an extremely valuable adjunct to the standard methods of fungal identification [*R.A.M.*, xvii, p. 175].

ROBERTSON (O. H.), BIGG (E.), MILLER (B. F.), & BAKER (ZELMA). **Sterilization of air by certain glycols employed as aerosols.**—*Science*, N.S., xciii, 2409, pp. 213–214, 1941.

Following up the work of Trillat in France (*Bull. Acad. Méd., Paris*, Sér. 3, cxix, p. 64, 1938), Pulvertaft and Walker in England [*R.A.M.*, xix, p. 152], and others on the germicidal efficiency of liquid aerosols, the writers, at the University of Chicago, tested the action of propylene glycol and certain closely related substances against *Staphylococcus albus* and other micro-organisms. In the case of *S. albus*, one part by weight of propylene glycol in 2,000,000 volumes of air effected complete sterilization of an atmosphere containing up to 200,000 bacteria per cu. l. of air, while the ethylene and trimethylene glycols were of approximately similar efficacy.

BENHAM (RHODA W.). **Cultural characteristics of Pityrosporum ovale—a lipophylic fungus. Nutrient and growth requirements.**—*Proc. Soc. exp. Biol., N.Y.*, xlvi, 1, pp. 176–178, 1941.

In further studies on the nutritional requirements of *Pityrosporum ovale* [*R.A.M.*, xix, p. 94], the fungus was found to develop in the presence of inorganic salts (Currie's liquid medium), glucose, and oleic acid (0·01 to 1 per cent.), growth being accelerated and the fungal yield increased by the addition of 0·5 per cent. asparagin. Thiamin and pyridoxin also exerted a stimulatory effect on the organism, but were not essential to its growth under the conditions of these tests.

McMurray (J.). **Some everyday problems in otolaryngology.**—*Penn. med. J.*, xciii, 12, pp. 1690–1692, 1940.

The fungi most commonly associated with otitis in the writer's practice at Washington, Pennsylvania, are *Aspergillus niger* [*R.A.M.*, xix, p. 703], *A. fumigatus*, *Monilia sitophila*, *M.* [*Candida*] *albicans*, and *Penicillium rubrum*, the most reliable therapeutic treatment against which is with a 45 per cent. alcoholic solution of phenylmercuric nitrate.

Klarmann (E. G.), Shternov (V. A.), & Costigan (S. M.). **A method for the evaluation of water-soluble and water-miscible fungicides used in the prevention of the spread of athlete's foot.**—Abs. in *J. Bact.*, xli, 1, p. 37, 1941.

Of the several species of pathogenic fungi associated with the condition known as 'athlete's foot', *Trichophyton rosaceum* [*R.A.M.*, xix, p. 594 *et passim*] shows the highest resistance to phenol. In order to determine the fungicidal efficacy of water-soluble and water-miscible disinfectants, the test organism is grown in Sabouraud's A broth for ten days at 28° C. The mycelial growth is removed by filtration through a 200-mesh, Monel-metal screen, and the spore suspension standardized by means of a haemocytometer. The inoculum for the tests contains 1,500,000 spores per ml., and its phenol resistance is such that it succumbs in ten minutes to a 1:70 concentration, but not to 1:90.

Mallett (E. T.). **Mold mycelia in butter.**—Abs. in *J. Bact.*, xli, 2, p. 271, 1941.

In the course of studies at the Ideal Pure Milk Co., Evansville, Indiana, to determine the relative importance of various factors in regard to the growth of moulds in raw cream and their application to farm conditions, it was found that cream produced with average precautions, cooled to 70° F., and held at that temperature, will keep to a maximum tolerance of four days, determined by the mould mycelium count on the resultant butter [*R.A.M.*, xx, p. 205]. Cream produced under excellent conditions and cooled by atmospheres ranging from 72° to 90° will also keep to a maximum tolerance of four days, while 60 hours is the limit for samples produced in insanitary surroundings. Cream produced under the above-mentioned excellent conditions and cooled to a constant temperature of 45° was still fresh after a fortnight.

Brown (W. H.) & Elliker (P. R.). **Factors affecting the mold content of cream.**—Abs. in *J. Bact.*, xli, 2, pp. 271–272, 1941.

Preliminary trials at Purdue University, Indiana, under conditions simulating those of local farms, indicated that the vigorous stirring of cream twice daily resulted in increased yeast and decreased mould growth [see preceding and next abstracts]. The addition of an active culture of starter prevented mould development for a week in raw cream held at 21° C.

Wildman (J. D.). **Laboratory studies on development of mold in cream.**—*J. Ass. off. agric. Chem., Wash.*, xxiv, 1, pp. 183–190, 1940.

In preliminary experiments the daily over-layering of heavy cream with fresh cream did not result in significant mould (mostly *Oospora*

*lactis*) at temperatures in the neighbourhood of 30° C. [see preceding abstracts], but when the daily additions were stirred into the previous accumulation extensive contamination occurred. The development of *O. lactis* was restrained, however, by cooling the cream to 20°. The combined effect of temperature and of the relative quantities of inoculum used was found to be important in the evaluation of mould incidence: on the basis of the experiments herein described and tabulated it would appear that for cream accumulated at 20° for a five-day period a mass inoculation is requisite for appreciable mould development, while for samples held at 30° there must be approximately one spore per ml. for substantial growth.

MUSKETT (A. E.) & COLHOUN (J.). **Prevention of stem-break, browning, and seedling blight in the Flax crop.**—*Nature, Lond.*, cxlvii, 3719, pp. 176–177, 1941.

In experiments made in 13 centres throughout Northern Ireland in 1940 flax seedling blight (*Colletotrichum lini*) was almost entirely eliminated by seed treatment with R.D. 7846 [*R.A.M.*, xix, p. 656], and by the short-wet method with ceresan U. 564. Proprietary organo-mercurial dusts of proved efficacy against *Helminthosporium* disease of oats [*H. avenae*: ibid., xvii, p. 809] also gave good control of *C. lini* when applied at double the rate, i.e., 10 oz. per bush. (56 lb.) of seed. The seed used had 18·2 to 35·7 per cent. infection. The same methods gave encouraging results against stem-break and browning (*Polyspora lini*) [ibid., xix, p. 644], the seedling and stem-break phases being largely eliminated, while the onset of the browning stage was longer delayed in flax from treated seed than in the control. In these tests seed with from 2·8 to 23·7 per cent. infection was used at five centres.

Scutching tests were also carried out on crops grown on replicated plots at the Agricultural Research Institute, Hillsborough. For the stem-break and browning trials a seed sample with 23·7 per cent. infected seed was used, and significant increases in fibre yield of 30 to 60 per cent. were obtained from crops where the seed had been subjected to one or other of the treatments. With seedling blight treatment gave increases in fibre yield of up to 30 per cent.

So far, R.D. 7846 has had no phytocidal effect on the crop, and, apparently, can be used three months before sowing without risk of reducing germinability. Calves and pigeons fed for a considerable period on heavily dressed flax seed showed no ill effects.

MUSKETT (A. E.) & MALONE (J. P.). **The Ulster method for the examination of Flax seed for the presence of seed-borne parasites.**—*Ann. appl. Biol.*, xxviii, 1, pp. 8–13, 1 pl., 1941.

An account is given of an investigation of different methods for the examination of flax seed samples for the presence of *Polyspora lini* and *Colletotrichum lini* [see preceding abstract], in an attempt to devise a rapid and accurate technique for determining percentage infection. Three methods of seed examination for the presence of *P. lini* were tested, namely (1) by placing each seed in a drop of water on a slide, scraping, and examining the water for spores, which was found to be a tedious procedure; (2) examination, after incubation on moistened filter

papers, for acervuli and spores, which proved laborious and otherwise unsatisfactory, and (3) the Ulster method, which was finally adopted for *C. lini* as well. This is as follows. The sample is thoroughly mixed, and the seeds are plated out on 2 per cent. malt extract agar in 9 cm. Petri dishes, ten seeds being spaced equidistantly in each dish. If only a general estimate of the health of the sample is required, 100 seeds are used, but if a more accurate assessment is necessary, 500 seeds are examined. Each seed is transferred to the medium with forceps which are sterilized after plating out each lot of ten seeds, the dishes are incubated at 22° C., and after five days the medium round each seed is examined for fungi. Evidence was obtained that *P. lini* is not spread during the normal operations of handling and mixing seed.

Details of a Danish method were supplied to the authors by Stahl and Kjaer. In this, 400 seeds of each sample are examined through a lens, and every doubtful seed is placed in a drop of 0·1 per cent. water solution of cotton blue for one hour before scraping and microscopic examination for the presence of *P. lini* spores. A comparative test by the authors demonstrated that this method gave less accurate results than the Ulster method. In several instances seed samples, the origin of which was unknown at the time of examination, were correctly determined by the Ulster method as being of Canadian origin, owing to the frequent occurrence of a species of *Alternaria*. The method also enables old and new seed to be distinguished, old samples being comparatively 'clean'.

KRAMER (M.). **Os mosaicos da Roseira no Estado de S. Paulo.** [Rose mosaics in the State of S. Paulo.]—*Biologico*, vi, 12, pp. 365–368, 2 pl., 1940.

The form of rose mosaic originally reported in São Paulo, Brazil, by the writer at the first South American Botanical Conference in 1938 and described in *Rev. agric.*, *Rio de J.*, xv, 7–8, pp. 301–311, 1940, is stated to correspond to Thomas and Massey's type 3 in California [*R.A.M.*, xix, p. 409]. It has been found occurring naturally on stocks of *Rosa manetti*, *R.* (?) *multiflora*, *R. canina*, and *R. rugosa*, as well as on a number of commercial varieties, including Black Prince (hybrid tea), white Maman Cochet (tea), Frau Karl Druschki (hybrid perpetua), and Kirsten Poulsen (polyantha).

Another form of the disease, apparently identical with that described by P. Brierley in *Amer. Nurseryman*, July, 1940, under the name of 'yellow mosaic', has also been observed on an unnamed variety (probably a hybrid tea) at the Biological Institute, Rio de Janeiro. Glistening, yellow spots develop in the spaces between the secondary veins and along the margins of the young leaves, and large, elongated, coalescent lesions of the same colour at the tips. On medium-sized leaves the contrast between the mosaic and normal zones is even more striking than on the young foliage, the areas involved by the discoloration being larger and mainly localized along the primary and secondary veins in the form of broad bands, which may diffuse over almost the entire lamina, leaving only a narrow strip of green beside the margin. Vein-clearing is a feature of the disease on older leaves, which may also develop scattered rings of chlorotic tissue with paler centres (the latter sometimes

turning greyish-purple as a result of invasion by secondary micro-organisms), situated at the points of convergence of the secondary and tertiary veins. A further difference between the ordinary and yellow rose mosaics lies in the formation in the latter disorder of elongated, discontinuous, well-marked, yellow lesions extending almost the whole length of the stem.

Control should be based on the selection for grafting purposes of healthy stocks, the reaction of which to mosaic may be tested by the use of scions of 'indicator' varieties, such as Madame Butterfly, Ophelia, and Radiance; stocks giving rise to infection in these should be rejected, while the remainder may be propagated by means of slips. Extreme care should be taken in the choice of scions from cultivated varieties, using only those from absolutely sound plants and thereby avoiding all risk of conveying the virus to stocks which might serve as sources of widespread dissemination.

Atkinson (J. D.). **Die-back of Lacebarks caused by Myxosporium hoheriae n.f.sp.**—*N.Z.J. Sci. Tech.*, A, xxii, 2, pp. 115–120, 3 figs., 1940.

Lacebarks (*Hoheria sexstylosa, H. populnea*, and *Plagianthus betulinus*), endemic flowering shrubs [Malvaceae] grown for ornamental or shelter purposes throughout New Zealand, have been found to suffer from a die-back caused by *Myxosporium hoheriae* n.f.sp. [with a Latin diagnosis]. The leaves of infected branches or shoots rapidly wilt and die. Underlying the soft, spongy bark are well-defined, light brown lesions; the diseased wood darkens with age, sometimes turning nearly black. Girdling is frequent, involving the death of all parts above the site of infection. The rupture of the small swellings in the cortex exposes elliptical, salmon-pink acervuli, 2 to 4 by 0·25 to 0·5 mm., usually single but occasionally confluent, and with a hymenial layer, consisting of a compact palisade of filiform, septate, cylindrical, hyaline, straight to curved, unbranched conidiophores, 20 to 100 by 2 to 3 $\mu$, producing at their apices elliptical, unicellular, hyaline conidia, 14 to 23 by 5 to 9 (mean 21 by 7) $\mu$. No perfect stage was observed. The fungus made good growth on potato dextrose agar at 21° C. Inoculation experiments with spore suspensions of *M. hoheriae* gave positive results on wounded seedlings only of the three above-mentioned species.

Gorman (L. W.). **Blind seed disease investigations.**—*N.Z. J. Sci. Tech.*, A, xxii, 2, pp. 79–83, 2 figs., 1940.

An account is given of experiments at the Plant Research Bureau, Palmerston North, New Zealand, on the control of blind seed disease [*Helotium* sp.] of rye grass [*Lolium perenne* and *L. multiflorum*: *R.A.M.*, xx, p. 122] by crop management. To date, the best results have been obtained with early crops (closed up during the last week of October) and those accompanied by a dense growth of a pedigree strain of white clover [*Trifolium repens*], in which the germination of the rye grass exceeded 90 per cent. and a seed yield of up to 47 bush. per acre was secured. Late-planted crops are susceptible both to blind seed and ergot (*Claviceps purpurea*).

Cornelius (D. R.) & Johnston (C. O.). **Differences in plant type and reaction to rust among several collections of Panicum virgatum L.**—*J. Amer. Soc. Agron.*, xxxiii, 2, pp. 115–124, 2 figs., 1941.

Considerable variations in their reactions to rust (*Uromyces graminicola*) were manifested by 34 accessions of the valuable forage grass, *Panicum virgatum*, from different parts of the Great Plains in tests in 1937, 1938, and 1939 at the Soil Conservation Service Nursery, Manhattan. Thus, two of the four Nebraska strains and the one North Dakota collection were extremely susceptible, with average rust percentages of 45·5 in 1937 and 1938 and 51·8 in 1939, whereas those from Oklahoma lowland and southern Texas were highly resistant, with only traces of infection in any of the trials. One upland strain from Oklahoma also combined satisfactory resistance to rust (maximum 4 per cent.) with particularly desirable constitutional characters. The Kansas collections were intermediate in respect of resistance to *U. graminis*, with an average percentage in 1937 and 1938 of 34·9 and in 1939 of 24·1 (one Oklahoma strain included in the figures for the last year).

Hockey (J. F.). **The present orchard disease situation.**—*Rep. N.S. Fruit Grs.' Ass.*, lxxvii, pp. 37–41, 1940. [Received April, 1941.]

During 1940 many complaints were received at Kentville, Nova Scotia, of russeting on Cox's Orange apples, and no solution to this problem has yet been discovered. Iron sulphate-lime sulphur mixture gave less russeting than any other sulphur spray [cf. *R.A.M.*, xviii, p. 532; xix, p. 157].

In a comparative test of the value of lime-sulphur and Bordeaux mixture against scab (*Venturia inaequalis*), one plot of 10-year-old McIntosh apples received Bordeaux mixture (5–15–100) and another lime-sulphur (2 in 100) on 22nd May, this being the first application. A calyx spray of Bordeaux mixture (1–3–100) and lime-sulphur ($1\frac{1}{2}$ in 100) was made on 11th June. On 22nd June the plot treated with Bordeaux mixture showed 11·3 per cent. scabbed foliage, and the other 1·6 per cent. On 28th June the former received a cover spray of Bordeaux mixture (3–10–100) and the latter one of lime-sulphur ($1\frac{1}{2}$ in 100), lead arsenate being added at the rate of 3 lb. per 100 gals. On 2nd October the lime-sulphur plot gave 86·5 per cent. clean fruit and 7·5 per cent. scab, the corresponding figures for the Bordeaux plot being 64·7 and 21·7 per cent., and for the unsprayed control 20 and 76·8 per cent.

Lime-sulphur should not be used when the temperature or humidity is high. If it is diluted to 1 in 100, the lead arsenate should be correspondingly reduced, a safe rule being to use not more than 2 lb. of lead arsenate to each gal. of lime-sulphur concentrate. Leaves which have grown during sunless days are more susceptible to lime-sulphur injury than leaves which have had a few bright days in which to harden.

Apple trees affected by false sting [ibid., xx, p. 213] should be eradicated, as the fruits never become marketable and grafts cannot be taken from such trees. Mosaic trees should also be removed, as this disease is also transmissible by grafting. A condition referred to as 'flat limb' also occurs on apple trees, especially on Gravenstein but the cause

of the disease has not yet been ascertained. As affected trees are very weak they should be removed.

LEACH (R.). **Banana leaf spot investigations. I. The basis of control.**—*J. Jamaica agric. Soc.*, xliv, 12, pp. 499–502, 1940.

Continuing his paper on the control of banana leaf spot (*Cercospora musae*) [*R.A.M.*, xx, p. 216], the author draws the following conclusions. In Jamaica most leaf-spotting of Gros Michel bananas by *C. musae* originates from infection of the heart leaves. Although some of the heart leaves are, necessarily, not reached, or at least not adequately covered, by the spray, yet spraying has given very good control, the indication being that its action does not altogether depend on its providing a protective covering against infection. The control given by spraying results chiefly from the fact that the operation interferes with spore production and affects the germination of those spores that may reach the unsprayed heart leaf. Damage depends primarily on the intensity of sporulation, which in turn is largely determined by the incidence of dew. Shade, by reducing dew formation, also diminishes spore production, and shade may in time prove to be the most economic means of control in areas where dew formation is not excessive. Appreciable damage from secondary infection on old leaves appears to occur only spasmodically. Injury is cumulative, and plants previously unaffected seldom suddenly develop infection of epidemic proportions. Thorough fortnightly spraying at the commencement of a campaign against leaf spot is advocated in order to make certain that all leaves (particularly each successive, newly affected, leaf) are covered with fungicide when sporulation starts on the spots developing from infection during the heart leaf stage. It may later prove to be possible to keep the disease in check with much less spraying than is at present employed on plantations where good control has already been achieved, but if the spraying cycles are lengthened, careful observations must be made of the amount of spotting on the third to fifth leaves, in order that a decision may be made as to whether spraying can be further deferred. Spray should be applied under pressure directly on the surface of the heart leaf or that of the recently opened leaves. A heavy covering of spray should be applied during dry weather. [This paper is also published as *Bull. Dep. Sci. Agric. Jamaica* 26, 1941.]

WARDLAW (C. W.). **The Banana in Central America. II. The control of Cercospora leaf disease.**—*Nature, Lond.*, cxlvii, 3725, pp. 344–349, 7 figs., 1941.

Banana leaf spot due to *Cercospora musae* [see preceding abstract] was not recorded in the western tropics until 1934, and there is little evidence how it became introduced into this area. Once it had become established in Central America, the economic loss rapidly became grave until it became clear that the industry was faced with the most serious crisis in its history. The data obtained, however, indicated that by spraying in cycles of two to three weeks with copper-containing preparations growers could give their plants a considerable degree of protection. Stationary spraying apparatus was at once installed on an immense scale, including power-houses, large spray-mixing tanks, pumping

units, and an ample pipe-line system through the plantations. A block of 700 to 800 acres was found to make a satisfactory unit for a single spraying project, several such units being necessary for each large banana division. On the Ullua River, Honduras, there is now a continuous area of some 60 sq. miles under permanent pipe-line spray control. In all, over 100,000 acres in Central America are now equipped with stationary spray installations.

All the evidence demonstrated that Bordeaux mixture was the most satisfactory fungicide for control purposes. Aeroplane dusting was found expensive and somewhat unreliable, and involved the disadvantage that it must be carried out while dew remains on the leaves, i.e., in the early morning. It may have its place, however, in areas where circumstances do not warrant the installation of permanent equipment. In this connexion it is pointed out that local methods of cultivation render the use of mobile spraying units impracticable. In the system used the pipes are just laid on the ground. A special repair squad is kept constantly at work. The spray is distributed by hoses attached to the delivery pipes, and dragged here and there over a limited area as required. Eight to ten hoses may be in use in one small area, each spray gun being opened and closed several times per minute; any undesirable effects from sudden changes in pressure are overcome by the insertion at intervals of vertical stand pipes (3 in. diameter, 4 ft. high), the air cushions so provided effecting a balance of pressure at the delivery nozzles.

The number of stools requiring spraying may reach 300 to 500 per acre; each is thoroughly wetted from four positions, the jet being directed just below the top of the highest leaves (30 to 40 ft. above the ground). At the high pressures used the spray almost resembles a fog, coverage being surprisingly good and very effective. After each day's work, the pipe-line system is washed out and left full of clean water. Spray residue is removed by dipping the freshly picked bunches in a dilute acid bath, followed by thorough washing in water.

In spite of the expense involved, the results obtained showed considerable profits, and demonstrated that this system of spraying had overcome an epidemic disease which had threatened a major industry with extinction. In fully grown plantations, the control of severe infection is difficult and costly, and takes a long time. The best procedure is to cut down all plants in affected areas and gain control as the young plants come up. Much difficulty was found in securing control in young plantations near badly affected areas, and in some instances control could not be obtained until the severely diseased areas had been cut down. As both adult and young leaves are susceptible, the whole stool should be thoroughly sprayed on each occasion, this process being continued until harvesting. While satisfactory commercial control has now been secured, the costs remain too high, and further research is still called for.

Wardlaw (C. W.). **The Banana in Central America. III. Panama disease.**—*Nature, Lond.*, cxlvii, 3726, pp. 380–381, 1941.

In discussing problems associated with Panama disease (*Fusarium oxysporum cubense*) of bananas with particular reference to the condi-

tions prevailing in Central America and the West Indies [cf. *R.A.M.*, xx, p. 170], the author states that on the lower Ullua River, Honduras, large areas have remained highly productive for some fifty years, with only a negligible amount of infection, in spite of periodic inundations by flood water bringing down debris from infected plantations. On the other hand, areas inland from La Ceiba have become seriously diseased within two years of planting. In these latter localities the evidence suggests a pre-cultivation dispersal of the fungus during the periodic flooding of the forests adjacent to the river, infection having been noted in flooded areas higher up. Many examples have been found of the resistance of old areas and the susceptibility of new. The evidence strongly suggests that conditions on the floor of virgin forests are specially favourable for the propagation and distribution of the causal organism.

In Central America the evidence, both practical and scientific, is that the chief factor in determining the severity of infection is the $P_H$ value of the soil, followed by soil texture.

An experiment is now in progress which consists in flood-fallowing an area of about 100 acres, previously put out of production by the disease. This area has been empoldered and divided into four sections, of which each is to remain submerged for a different period up to 18 months. This investigation is based on the fact that soil fungi require oxygen, and that when highly infected soil had been submerged for one month beneath 2 ft. of water *F. oxysporum cubense* could no longer be found in it. Observations have also shown that in new land built up by the sedimentation of controlled flood water, and hence subjected to several inundations, the incidence of Panama disease was negligible.

RUEHLE (G. D.). **Zinc deficiency of the Avocado.**—*Proc. Fla hort. Soc.*, liii, pp. 150–152, 1940. [Abs. in *Chem. Abstr.*, xxxv, 4, p. 1173,1941.]

Mild cases of zinc deficiency in avocado trees in Florida are characterized by chlorosis of the interveinal areas of the leaves, which become progressively smaller, trough-shaped with a recurvate tendency, and yellow to slightly bronzed, especially between the veins. The reduction of twig growth curtails the distance between the leaves and imparts a rosette-like aspect to the foliage. Severely affected old leaves often show many small, dead spots, while the fruit is usually small, with a marked inclination to sunburn and necrotic spotting of the skin. Terminal twigs may die back from a few inches to several feet. Severe cases of zinc deficiency may be corrected by spraying the trees with 10–15–100 zinc sulphate-lime, half the amount sufficing for milder forms of the trouble, which is thought to be associated with the exclusive use of synthetic nitrogenous fertilizers.

RUEHLE (G. D.) & LYNCH (S. J.). **Copper sulfate as a corrective for die-back, a new disease of the Avocado.**—*Proc. Fla hort. Soc.*, liii, pp. 152–154, 1940. [Abs. in *Chem. Abstr.*, xxxv, 4, p. 1173, 1941.]

The older leaves of avocado trees suffering from a new form of die-back in the light sandy soils of the Ridge section of Florida present a dull appearance, the veins becoming prominent at first and then assuming a reddish-brown tinge which may gradually spread into the

leaf blades. The premature shedding of affected foliage may be accompanied by a dying-back of the tips. At an advanced stage of the trouble, multiple buds are formed at the tips of the twigs, sometimes producing a cluster 0·75 in. in diameter, the new leaves put forth by which, however, successively shrivel and die back until the whole twig bearing the adventitious growth is dead. The disease appears to be due to copper deficiency and remediable, in the early stages at any rate, by applications of copper sulphate to the soil.

RUEHLE (G. D.). **Spraying experiments for control of Avocado anthracnose.**—*Proc. Fla hort. Soc.*, liii, pp. 155–158, 1940. [Abs. in *Chem. Abstr.*, xxxv, 4, p. 1172, 1941.]

Anthracnose (*Colletotrichum gloeosporioides*) on the blossom spikes and fruit of avocado is stated to be largely controllable in Florida by the timely application of copper fungicides, the first treatment being given when the spikes are well open but before the unfurling of the individual flowers, while one or two additional bloom sprays are necessary to control spike and early fruit infection, followed by at least two during the post-blossom period to combat late attacks on the fruit. Good results have been obtained with 4–4–100 Bordeaux mixture, red copper oxide, and tribasic copper sulphate, both the two latter at 3–100.

PRESCOTT (S. C.) & DUNN (C. G.). **Industrial microbiology.**—x+541 pp., 28 figs., 19 diags., 13 graphs, New York and London, McGraw-Hill Book Company, Inc., 1940. 35*s*.

Among the sections of mycological interest in this comprehensive treatise on industrial microbiology may be mentioned those dealing with the activities and industrial applications of the yeasts and moulds (the latter including the fermentation of citric and other acids, the uses and products of mould enzyme preparations, and fat production by moulds), and the microbiology of textiles and wood.

THARP (W. H.), WADLEIGH (C. H.), & BARKER (H. D.). **Some problems in handling and interpreting plant disease data in complex factorial designs.**—*Phytopathology*, xxxi, 1, pp. 26–48, 2 graphs, 1941.

Frequently, when plant disease data expressed as percentages or some other relative scale of an index system are subjected to the analysis of variance it may be found necessary to transform them to some new scale in order to obtain a valid estimate of the generalized standard error. In this paper the authors discuss the problems of the selection of the proper transformation with particular reference to the case of a factorially designed experiment in Arkansas on the resistance of cotton to wilt (*Fusarium*) [*vasinfectum*: *R.A.M.*, xvii, p. 524].

EHRLICH (J.). **Etiological terminology.**—*Chron. bot.*, vi, 11, pp. 248–249, 1941.

The author recognizes three economically important classes of phytopathological effects: (1) disease, the sustained physiological and resulting structural disturbances of living tissues and organs, ending sometimes in death due to the activity (pathogenesis) of a pathogen; (2) decay, the degradation and disintegration of dead tissue (saprogenesis, saprogen);

and (3) stain, the abnormal coloration of living or dead tissue (chromogenesis, chromogen). In conformity with this terminology he proposes thryptogenesis and thryptogen to replace thryptophytism and thryptophyte [*R.A.M.*, xv, p. 694].

It is suggested that the terms 'inoculation stage', 'incubation stage', and 'infection stage', originally applied by Whetzel to pathogenesis only, be also used to designate the stages of saprogenesis and chromogenesis, and that infection, generally restricted to living suscept tissue, be extended to apply to any organized biotic tissue; infestation and contamination being applied to unorganized media (e.g., agars, soil).

Chupp (C.). **Diehl's double cover-glass mounts.**—*Chron. bot.*, vi, 10, pp. 226–227, 1941.

This note gives detailed directions for making double cover-glass mounts [*R.A.M.*, xix, p. 486]. It is essential that both the glassware and the glycerine used for mounting shall be free from moisture if cloudiness of the balsam is to be avoided. Any desirable stain can probably be used provided it is compatible with potassium acetate, alcohol, and glycerine.

Crowell (I. H.). **Use of dichloricide in the control of scavenger mites in test tube cultures.**—*Mycologia*, xxxiii, 1, p. 137, 1941.

Scavenger mites were successfully killed in test-tubes containing cultures of 200 different species of fungi without evident injury to the fungi by exposing the contaminated tubes to the effect of gas from dichloricide crystals. The test-tubes and a watch glass with $\frac{1}{4}$ oz. crystals were left for one hour together under a sealed glass bell jar, and the gas drawn into the tubes by alternately exhausting air and releasing negative pressure. Another successful method was to place a crystal between the cotton wool plug and the wall of the tube, no living mite being observed the following morning.

Stevens (N. E.). **Botanical research by unfashionable technics.**—*Science*, N.S., xciii, 2408, pp. 172–176, 1941.

In this address to the Section for the Botanical Sciences of the American Association for the Advancement of Science, the author states that his method of calculating disease indices for cereal crops from the amount of matter published on various diseases [*R.A.M.*, xviii, p. 580] has met with a good many amused comments and been considered not very scientific, but that his conclusions, drawn from these calculations, to the effect that disease losses are much higher in self-pollinated crops than in those which are largely cross-pollinated, have not yet been attacked. He defends the value of estimates generally and particularly those of crop losses because of their importance for the recommendation of disease control measures. In general, the point of view is put forward that science is in danger from too much regard for alleged accuracy and methodology and should devote itself more to practical aspects and dare to advance suggestions and opinions of practical value, even though they be based on mere estimates and not supported by measurements.

Selman (I. W.). **Control of plant virus diseases by cultural methods.**—*Nature, Lond.*, cxlvii, 3719, pp. 181–182, 1 diag., 1941.

In the light of his studies at the Cheshunt Research Station the author

develops the thesis that virus infection should be regarded as akin to the external environmental factors affecting plant growth and that the symptom expression is determined by the interaction of virus infection and these factors. Changes within the plant induced by a virus can, it is claimed, be counterbalanced by the judicious adjustment of the environmental factors, and the bearing of this on the control of virus diseases is instanced by the helpfulness of assuming that an environmental factor is at fault, in conjunction with the disease itself, when called upon to advise treatment for virus-infected tomato plants.

VALLEAU (W. D.). **The binomial system of nomenclature for plant viruses.**—*Chron. bot.*, vi, 10, pp. 223–224, 1941.

The author briefly reviews and discusses the proposals for virus nomenclature that have been put forward from time to time by various workers [*R.A.M.*, xx, p. 174]. He points out that Holmes's families are based on plant reaction, rather than on virus characteristics, and, further, completely unrelated viruses are placed in a single genus. The scheme greatly simplifies nomenclature, but does not assist classification.

SMITH (K. M.). **Some notes on the relationship of plant viruses with vector and non-vector insects.**—*Parasitology*, xxxiii, 1, pp. 110–116, 2 pl., 1941.

In experiments at the Rockefeller Institute, Princeton, New Jersey, and at the Division of Sugar Plant Investigations, Riverside, California, extracts of the large tobacco 'hornworm' (*Protoparce sexta*) and other caterpillars were shown to inhibit the infectivity of the tobacco mosaic and tobacco necrosis viruses, as judged by the effect on bean (*Phaseolus vulgaris*) plants [*R.A.M.*, xix, p. 556]. The inhibitor was not sedimented after 2½ hours' spinning at 30,000 r.p.m. The potato virus X, tobacco ring spot, and sugar beet curly top viruses were found to be destroyed within the body of *Protoparce sexta*, from the faeces of which the tobacco necrosis virus was twice recovered in very small amounts, while that of tobacco mosaic was uniformly present, though in greatly reduced concentration. The last-named virus can thus be separated from a mixture by passage through the hornworm caterpillar. By the use of the specific insect vector (*Eutettix tenellus*) and artificial feeding methods [*R.A.M.*, xv, 549], the beet curly top virus was recovered 24 hours after injection into the caterpillar's blood, but tobacco mosaic and tobacco necrosis failed to survive under these conditions. Experimental evidence is briefly adduced to prove that the saliva of *E. tenellus* is the actual medium of transmission of the curly top virus.

STANLEY (W. M.). **Some chemical, medical and philosophical aspects of viruses.**—*Science*, N.S., xciii, 2407, pp. 145–151, 1941.

In this paper, read on the occasion of the presentation to the author of the Gold Medal of the American Institute of the City of New York for crystallizing the virus of tobacco mosaic, the history of his own and other workers' research on the isolation of viruses is surveyed and some of the implications of the successes obtained are outlined.

BOSWELL (J. G.). **The biological decomposition of cellulose.**—*New Phytol.*, xl, 1, pp. 20–33, 1941.

This is a review of investigations on two aspects of the biological decomposition of cellulose, namely, the cellulose activity of germinating seeds, and the activity in the decomposition of cellulose of bacteria and fungi, of which certain moulds and timber-rotting organisms have been most extensively studied [cf. *R.A.M.*, xvii, p. 495]. Evidence has been obtained that in some members of these groups the process of decomposition is facilitated by oxidation, leading to the formation of oxycellulose containing uronic acid molecules.

EFEYKIN (A. K.). Восстановление южного выроҗденного Картофеля в условиях средней полосы СССР. [The regeneration of degenerated Potatoes from the south under conditions of the central zone of the U.S.S.R.]—*Sovetsk. Bot., 1940,* 5–6, pp. 242–251, 1 fig., 1 graph, 1940.

Degeneration of potatoes in southern districts of the U.S.S.R. [*R.A.M.*, xix, p. 359] is stated to cause a fall in production of varieties yielding 20 to 30 tons per ha. further north to about 5 to 6 or even 2 to 3 tons after a cultivation period in the south of three to five years. The plants become progressively dwarfed, the stems thin and often curled, the leaves rugose and curled, and the tubers assume abnormal shapes. The precise nature of this disorder remains as yet unknown, although the author suggests that it may be due to the toxic effects of a disturbed metabolism under the influence of high temperatures.

The results of three years' experiments at the Agricultural Institute of Tchuvashia at Tcheboksary [central U.S.S.R.] showed that degenerated potatoes obtained from southern districts recovered gradually and at the end of the experimental period differed neither in yield nor in appearance from plants of the same varieties permanently cultivated under Tchuvashian conditions.

CHAMBERLAIN (E. E.). **A masked virus of Aucklander Short-Top Potatoes.**—*N.Z.J. Sci. Tech.*, A, xxii, 2, pp. 57–71, 8 figs., 1940.

In 1935 a severe top necrosis of potatoes first observed at Ashburton and Lincoln, New Zealand, was investigated and found to be transmissible by grafting and juice inoculation, but not by insects, from externally healthy plants of the Aucklander Short-Top variety to Arran Chief, Up-to-Date, President, Epicure, and King Edward, all of which contracted virulent symptoms, including extensive necrosis and collapse of the leaves and stems, and tuber decay (deep-seated in Arran Chief, President, and Epicure, and more or less superficial in Up-to-Date and King Edward). Infected tubers of Arran Chief, Up-to-Date, and Epicure often fail to germinate, and such plants as develop from them are stunted, with foliar spots, yielding poorly, and in the case of Epicure frequently dying prematurely. Inarching proved to be a more effective method of inoculation than core-grafting. The following varieties, grown in proximity to Aucklander Short-Top in selection trials, developed up to 10 per cent. severe infection: Dakota, Arran Chief, King Edward, Up-to-Date, Field-Marshal, and Early Regent, while similar symptoms were observed in commercial crops cultivated

next to Aucklander Short-Top in the previous season. The disease in question is presumably identical with that carried in a masked form by Aucklander Short-Top.

Inoculation experiments with the virus by leaf-rubbing on tomato, Warne tobacco, *Nicotiana rustica*, *N. glauca*, *Petunia hybrida*, and *Datura stramonium* gave uniformly positive results. The primary symptoms (sometimes absent) on tobacco take the form of pale spots surrounded by two concentric rings on the leaves, while secondary features may be either severe, involving pronounced vein-clearing, downward curling of the tips, interveinal necrosis, and stunting, or mild, characterized by faint mottling with little or no effect on the plants. The mild form of infection appears to result from an attenuation of the virus, either through age, heating, or substantial dilution. In *N. glauca* the ring spots may be composed of up to three concentric, light-coloured zones. On *N. rustica* the infected leaves turn pale and show a mosaic mottling in which the darker green areas consist of narrow bands along the veins; necrotic markings and chlorosis develop and finally death ensues. Inoculated tomato leaves show dark brown, almost circular lesions, 1 to 2 mm. in diameter; secondary symptoms appear as a mild mosaic with the dark green areas occurring as bands along the veins. *P. hybrida* foliage infected by the Short-Top virus displays a well-defined mottling, the areas bordering the veins being abnormally dark and the tissues between of a pale colour. In *D. stramonium* the affected leaves also exhibited a well-marked mottling, due to pallor of the main portion of the lamina and a dark green coloration of some of the smaller veins.

The longevity *in vitro* at 22° C. of the Short-Top virus from potato and tobacco was between 21 and 35 and longer than 35 days, respectively. The juice from infected tobacco appears to tolerate dilution to a greater extent than that from potatoes, the former inducing symptoms on all inoculated tobacco plants at a dilution of 1 in 50,000, while the latter infected only one-third at 1 in 10,000. The thermal death point of the virus from both hosts lies between 65° and 70°. It was unable to traverse the 'preliminary', 'regular', or 'fine' grades of Mandler filter candles. The Aucklander Short-Top virus appears to be quite distinct from any of the potato viruses listed by K. M. Smith or described by other writers.

Alten (F.) & Orth (H.). **Untersuchungen über den Aminosäuregehalt und die Anfälligkeit der Kartoffel gegen die Kraut- und Knollenfäule (Phytophthora infestans de By).** [Studies on the amino acid content of the Potato and its susceptibility to plant and tuber blight (*Phytophthora infestans* de By).]—*Phytopath. Z.*, xiii, pp. 243–270, 1940. [Abs. in *Chem. Zbl.*, cxi (ii), 21, pp. 2944–2945, 1940.]

The development of *Phytophthora infestans* on potato tubers was shown by experiments at the Lichtenfelde (Berlin) Agricultural Experiment Station to decrease parallel with rising doses of potash, coinciding with a simultaneous decline in the total, protein, non-protein, and $\alpha$-amino acid nitrogen contents of the tubers and leaves. Early, medium-early, and late varieties likewise showed differences of nitrogen content corresponding to their varying degrees of susceptibility.

Nitrogen-containing substances appear to exert a strong influence on the reaction of potatoes to *P. infestans*. In experiments with $\alpha$-amino acids sporangial germination was promoted by the majority of the preparations tested, but sulphur-containing compounds and arginin inhibited or killed the sporangia, the lethal action of arginin being little affected by association with stimulatory amino acids. The *dosis toxica* of arginin lies between 0·09 and 0·1 per cent. for a 48-hour treatment, its toxicity being independent of hydrogen-ion concentration. The arginin content of potato tubers and leaves increases progressively with rising doses of potash, and the evidence to date indicates that this substance is a contributory factor in resistance to late blight.

BAWDEN (F. C.). **Problems in breeding for disease resistance.**—*Chron. bot.*, vi, 11, p. 247, 1941.

Referring to Reddick's recent paper [*R.A.M.*, xx, p. 129], in which he questioned the utility of breeding potatoes which, though resistant to blight [*Phytophthora infestans*], were destined to succumb to virus X [ibid., xx, p. 220], the author points out that provided the original blight-resistant seedling is not actually lost, the outlook with a variety that dies when infected is brighter than with a more tolerant one. Viruses are obligate parasites, and in killing their hosts go far to eliminate themselves. In Great Britain, several widely grown potato varieties, e.g., King Edward and Epicure, are killed by virus X, with the result that commercial stocks are seldom contaminated. With more tolerant varieties, however, affected plants remain a source of infection, and the planting of apparently normal tubers perpetuates and increases the virus. Three methods may be followed in breeding against obligate pathogens, i.e., the production of tolerant, immune, or highly intolerant varieties. The first, in addition to the disadvantage indicated above, leads to the production of large reservoirs of infection. With regard to the second, there is small evidence that parents with the necessary genes exist. The third method, however, may confer what amounts to field immunity. Varieties may be so intolerant that the tissues are immediately killed by contact with the pathogen. This phenomenon may prove of great value in the control of tobacco mosaic, as the genes enabling *Nicotiana glutinosa* to localize the virus have been transferred to tobacco. Alternatively, varieties may be systemically hypersensitive, with the result that the whole plant succumbs, and so benefits the rest of the crop. By crossing potato varieties intolerant of one or more of four viruses, the Scottish Society for Research in Plant Breeding has produced Craig's Defiance, which is intolerant of all four, with the result that stocks are virtually immune from them in the field.

DYKSTRA (T. P.). **Results of experiments in control of bacterial ring rot of Potatoes in 1940.**—*Amer. Potato J.*, xviii, 2, pp. 27–55, 1941.

The author has summarized and tabulated the data supplied by workers in various States of the American Union in which experiments in the control of potato ring rot (*Phytomonas sepedonica*) [*Bacterium sepedonicum*] were carried out in 1940. [Some of the work has already been noticed: *R.A.M.*, xx, p. 176.]

Trials in California by J. B. Kendrick and C. E. Scott showed the

cutting knife to be the most effective agent in the spread of the pathogen, the incidence of diseased hills resulting from the cutting of healthy tubers alternately with infected ones being 78, 65, 90, 55, and 56 per cent., respectively, in five tests, an average of 69 per cent. Tuber-unit trials further showed that, once a knife becomes contaminated, the organism may be conveyed as far as the 24th succeeding sound tuber, and that one slightly diseased potato in 25 may result in 90 to 100 per cent. infected hills. Another experiment demonstrated the transmission of *Bact. sepedonicum* by contact between diseased and healthy seed pieces, 138 out of 200 hills (69 per cent.) produced by originally sound pieces shaken up in a bag with diseased ones (1 diseased to 20 healthy) showing ring rot symptoms. When whole tubers were dipped for a moment in an aqueous suspension of ground diseased potatoes, infection developed in 33 per cent. of the resultant hills. The picker-planter (in contrast to the assistant-feed type) proved to be a fruitful source of ring rot spread, the amount of which may be doubled or trebled by its use: in two tests in which healthy seed pieces and small whole tubers were punctured after the implement had been used on diseased material, 64 and 45 per cent. ring rot developed, respectively. In other tests in California the incidence of ring rot was found to be lower on whole seed than on seed pieces, amounting to 16 and 40 per cent., respectively, in one case and to 3 and 9 per cent., respectively, in another. There appears to be little likelihood of *Bact. sepedonicum* overwintering in the soil under Californian conditions, and the same applied, according to J. M. Reader's preliminary tests, to Idaho. 'Volunteer' potato plants, however, may serve to tide the pathogen over from one season to the next, and W. E. Brentzel in North Dakota observed a trace of infection in plants grown in soil used for the overwintering of large stocks of diseased material. The consensus of evidence from the collaborative reports indicates that the spread of the disease under natural field conditions is not an important factor in its perpetuation. The use of apparently healthy seed from contaminated stock is an unwise practice, 10·5 and 4 per cent. infection, respectively, having developed from such tubers in two tests. It is likewise inadvisable to plant seed from fields containing only a trace of the disease, according to H. Darling's experiments in Alabama, where 8, 9, 5, and 2 per cent. infection, respectively, developed in plants from whole seed from areas of limited infestation in four States, the corresponding figures for those produced by seed pieces being 13, 35, 4, and 2 per cent., respectively. Tests by C. J. Eide and R. B. Harvey in Minnesota showed that *Bact. sepedonicum* can persist in a viable condition for 121 days in sacks used for the storage of diseased potatoes.

In Colorado studies were conducted by D. P. Glick and W. A. Kreutzer to determine the relationship between *Bact. sepedonicum* and *Erwinia carotovora*. No rot developed in tubers infected by the former without the latter, and *E. carotovora* alone also failed to cause infection but induced a severe and rapid rot when inoculated into a ring rot-infected tuber.

Details are given of the use of ultra-violet light for the detection of ring rot in various states. In Montana, where this method was first employed by F. J. Harrington and co-workers, the most satisfactory

equipment has been found to consist of a 100-watt, 220-volt, H-4 type black lamp with transformer and Bryant base screw socket, the examination being carried out at temperatures of 40° F. or below in a totally dark room.

Of the various disinfectants tested in a number of States for the treatment of cutting knives, 1 in 1,000 mercuric chloride, with or without acidification, and 1 per cent. iodine were the most effective.

A widespread propaganda campaign against ring rot was conducted in 1940 by the extension services of State agricultural colleges with the co-operation of various publicity agencies.

TOCHINAI (Y.) & NAKANO (T.). **Studies on the nutritional physiology of Piricularia oryzae Cavara.**—*J. Fac. Agric. Hokkaido Univ.*, xliv, 4, pp. 183–229, 1940.

The following formula was found to constitute an appropriate synthetic solution for the culture of *Piricularia oryzae*, the agent of the 'imochi' [blast] disease of rice in Japan [*R.A.M.*, xi, p. 538; xviii, p. 546; xix, p. 673, *et passim*]: 2 gm. potasium nitrate, 0·5 gm. each of monopotassium and dipotassium phosphates and magnesium sulphate, 0·1 gm. calcium chloride, a trace of ferric chloride, 30 gm. sucrose, and 1,000 c.c. redistilled water. The fungus appeared to be able to utilize carbohydrates and higher alcohols as the carbon source, notably maltose, soluble starch, glucose, glycerine, and mannite (in the order named), while the best source of nitrogen was peptone, followed by sodium nitrate, asparagin, glutamic acid, and acetamide. *P. oryzae* further made slight vegetative growth in nutrient solutions containing 0·125 per cent. sodium or potassium nitrite, usually regarded as antagonistic to fungal development. No growth occurred, however, at concentrations of 0·25 per cent. A stimulus to growth was afforded by concentrations of ferric chloride below $\frac{1}{2,000}$ mol. and of copper sulphate under $\frac{1}{60,000}$ mol., whereas at higher strengths these compounds tended to retard development, and at $\frac{1}{1,600}$ and $\frac{1}{1,000}$ mol., respectively, inhibition was complete.

CHANDLER (W. V.) & SCARSETH (G. D.). **Iron starvation as affected by over-phosphating and sulfur treatment on Houston and Sumter clay soils.**—*J. Amer. Soc. Agron.*, xxxiii, 2, pp. 93–104, 4 graphs, 1941.

In tests at the Alabama Agricultural Experiment Station the application of superphosphate in varying amounts up to 6,400 lb. per acre to Houston ($P_H$ 7·78) and Sumter (highly calcareous) clay soils in 1-gal. pots induced iron chlorosis in groundnuts in both cases, the disturbance being particularly severe in the latter series. The chlorotic symptoms were counteracted by the incorporation with the soil of elemental sulphur at the rate of up to 8 tons per acre, the treatment being more effective on Sumter than on Houston clay. Lucerne did not suffer from chlorosis as a result of the superphosphate applications. The data obtained from chemical analyses suggested that a substantial proportion of the available iron in the soil may be assimilated by the groundnuts in such a way as to afford no protection against chlorosis.

MATSUMOTO (T.) & HIRANE (S.). **On the causal organism of a bacterial soft rot of Poppy in Formosa.**—*Trans. nat. Hist. Soc. Formosa*, xxxi, 208, pp. 1–13, 4 figs., 1941. [Japanese, with English summary.]

Opium poppies [*Papaver somniferum*] in Formosa were observed in the spring of 1940 to be infected by a disease which attacked the stem at or just above soil surface, or at the base of the petiole of young plants. The infection was accompanied by soft rot and internal disintegration. On adult plants, the affected part showed external discoloration and internal disintegration accompanied by a slimy exudation and stem-breaking at this point. The organism isolated from infected material was either identical with or closely related to *Bacillus* [*Erwinia*] *aroideae*, and corresponded in its general characters with the isolate of this species from radish [*R.A.M.*, xx, p. 9], though the two organisms were quite different serologically and bacteriophagically. The poppy organism did not agglutinate even at a serum concentration of 1 in 10 when tested against the antiserum of the radish organism, but was agglutinable in the homologous serum in all the dilutions up to 1 in 25,600. The radish organism was inagglutinable in the antiserum of the poppy organism. Further, the poppy organism was quite insensitive to the bacteriophage from rotten radishes. The authors hesitate to conclude that the poppy organism is entirely identical with that obtained from radish, but tentatively identify both with *E. aroideae*.

CARPENTER (C. W.). **A Chytrid in relation to chlorotic streak disease of Sugar Cane.**—*Hawaii. Plant. Rec.*, xliv, 1, pp. 19–33, 12 figs., 1940.

Following a summary of previous investigations on chlorotic streak disease of sugar-cane [*R.A.M.*, xx, p. 178], the writer describes his current studies on the disorder in Hawaii, where latent infection is stated to be widespread and liable to cause appreciable damage in a symptomless form. In fact, the failure of P.O.J. 36 to maintain its early promise as a prolific yielder is attributed in well-informed circles largely to this factor, losses from which in susceptible varieties have been estimated by J. P. Martin and Conant at 15 to 20 per cent.

Among the numerous organisms cultured from the tissues of diseased plants is a Chytrid with *Chondrioderma*-like amoeboid stages which apparently only grew in association with bacteria. In the affected tissues a Chytrid occurred in the form of small and subhyaline, slightly larger, grey, or large brown to black, opaque spheres (sporangia), 5 to 60$\mu$ in diameter, but its relationship to the fungus isolated has not yet been demonstrated. In addition other spherical, hyaline bodies, 3 to 25$\mu$ in diameter, were observed in the tissues, the larger ones (? hypnospores) having thick walls and being generally reminiscent of the spherical spores of the fungus obtained in culture from dry leaf sheaths of infected canes. Associated with the dark-coloured sporangia in the parenchyma cells of the stalks are rounded protoplasmic bodies, 5$\mu$ in diameter, disposed along a scarcely discernible strand of the fungus on the inner surface of the host cell wall in a manner suggestive of the turbinate bodies and habit of a species of *Physoderma*. It is impossible at the present juncture to interpret the various phases in the life-cycle

of the Chytrid, but the dark-coloured sporangia apparently prepare for germination by the development of a gelatinous cap, while later many oil drops and vacuoles of varying size are formed, or the contents may emerge as minute, spherical (?) sporangia, or again as a thallus-like outgrowth. This plasmodium-like material further occurs in the shape of irregular units and small spheres in the stalk cells, similar elements also being found among the foliar chloroplasts and in the rudimentary leaves of the cane bud.

The organism under discussion has most frequently been detected in the parenchyma both above and below the nodes, near the centre of the externally sound stalks as well as close to the rind. The xylem and phloem may occasionally be invaded, but the parenchyma and storage tissue seem to be preferred. The fungus occurs just below the epidermal cells of the rind, and portions of the plasmodium-like thallus have been observed in juxtaposition within and outside the rind immediately above the bud, clearly denoting a point of entrance or exit of the pathogen. In the leaves the parenchyma and chlorophyll-bearing cells are similarly involved. The yellow or red gum deposits in the conducting vessels, particularly of the nodes, as well as in the leaf xylem, appear to be a product of the host rather than an accumulation of extraneous organisms, but their exact relationship to the leaf streaking typical of the disease is still obscure.

Attention is drawn to some striking analogies between chlorotic streak of sugar-cane and the course of *P. zeae-maydis* [*P. maydis*] in the maize plant, not necessarily entailing a taxonomic affinity.

L. (H. M.). **Downy mildew of Sugar Cane.**—*Int. Sug. J.*, xliii, 507, pp. 80-81, 1941.

Following a general statement regarding the present position of sugar-cane downy mildew [*Sclerospora sacchari*] in Queensland [*R.A.M.*, xx, p. 230], the writer summarizes a recent paper by N. J. King (*Cane Grs' quart. Bull., 1940,* 8, p. 29, 1940), describing the work of breeding seedlings at the Bundaberg Experiment Station since the inception of these operations in 1930, at which time the three standard varieties were D. 1135, M. 1900, and Q. 813, and the disease problem was confined to gumming [*Bacterium vasculorum*]. In 1933 P.O.J. 2878 and P.O.J. 213 were released for general distribution, followed the next year by Co. 290, P.O.J. 2725, and P.O.J. 234; among these P.O.J. 2878 is resistant to gumming, but highly susceptible to Fiji disease and downy mildew; P.O.J. 213 is resistant to gumming and Fiji, but very susceptible to mosaic and downy mildew; while P.O.J. 2725 is resistant to all but Fiji disease. During 1938 there was a widespread extension of the last-named and downy mildew throughout the Bundaberg area, necessitating the rejection of a number of promising seedlings of approved agricultural standards and showing adequate resistance to gumming. So far, the nearest approach to the ideal cane is Q. 25, a product of P.O.J. 2875×H.Q. 409, which is resistant to gumming and downy mildew, though susceptible to mosaic and Fiji. Although the new variety does not yet figure on the approved list, arrangements are in progress for its distribution, under proper safeguards, to local growers.

ARWIDSSON (T.). **Mykologische Beiträge.** [Mycological contributions.] —*Bot. Notiser*, *1940*, 4, pp. 370–388, 1940.

The present instalment (parts 5 to 9) of the writer's mycological contributions comprises annotated observations on a number of Greek Uredineae, some parasitic fungi from Nova Zembla, and, *inter alia*, comments on certain unusual Swedish fungi, including *Puccinia aecidii-leucanthemi* on *Chrysanthemum leucanthemum* and *P. antirrhini* on *Antirrhinum orontium* [*R.A.M.*, xvi, p. 679].

WEST (E.). **Notes on Florida fungi. II.**—*Mycologia*, xxxiii, 1, pp. 38–49, 2 figs., 1941.

This second list of Florida fungi [cf. *R.A.M.*, xviii, p. 820] contains 30 species, including *Phakopsora zizyphi-vulgaris* found severely attacking *Zizyphus jujuba* [ibid., xvi, p. 279] and less severely *Z. mauritiana*, believed to be the first record of this fungus in America, and *Puccinia cannae* on *Canna indica*.

MANEVAL (W. E.). **Some recent records of plant pathogens in Missouri.** —*Plant Dis. Reptr Suppl.* 125, pp. 151–164, 1940. [Mimeographed.]

A list is given of 95 plant pathogens (mostly fungi) either detected in Missouri since the compilation of the writer's previous catalogue [*R.A.M.*, xvi, p. 838] or found for the first time on a new host.

OVERHOLTS (L. O.). **New species of Polyporaceae.**—*Mycologia*, xxxiii, 1, pp. 90–102, 12 figs., 1941.

This annotated list of ten new species of American Polyporaceae [with English diagnoses only] is based on hitherto unidentified or incorrectly named material.

YAMAMOTO (W.). **Formosan Meliolineae II, III, IV.**—*Trans. nat. Hist. Soc. Formosa*, xxx, 206–207, pp. 414–425, 35 figs., 1940; xxxi, 208, pp. 14–30, 40 figs.; 209, pp. 47–60, 43 figs., 1941.

The present series of contributions to the knowledge of Formosan Meliolineae [*R.A.M.*, xix, p. 617] comprises 42 species, all but three of which are new and furnished with Latin diagnoses.

HIRATSUKA (N.). **Materials for a rust-flora of Riukiu Islands. I.**—*Bot. Mag., Tokyo*, liv, 641, pp. 157–167, 1940.

An annotated list is given of 55 rusts collected by the author in the Riu-kiu Islands, Japan, in the early months of 1940.

STEVENS (N. E.). **Host relations in species of Diplodia and similar genera.**—*Mycologia*, xxxiii, 1, pp. 69–73, 1941.

In this paper the author expounds his concept of host relations in species of *Diplodia* and similar genera, which is stated to be diametrically opposed to that of Grove [*R.A.M.*, xvii, p. 68], who lists the species of *Diplodia* on different hosts under different names. Stevens, on the other hand, argues that such fungi are species with a wide host range rather than distinct species and supports his contention with various examples taken from the literature.

Best (R. J.). **Methods for the preparation of pure Tobacco mosaic virus nucleoprotein (Marmor tabaci var. vulgare, Holmes).**—*Aust. J. exp. Biol. med. Sci.*, xviii, 4, pp. 401–403, 1940.

In previous papers [*R.A.M.*, xv, p. 404 *et passim*] the author has merely outlined the general principles on which his purified samples of tobacco mosaic have been prepared at the Waite Agricultural Research Institute, Adelaide: in response to increasing interest in the subject, a detailed account of the methods employed is given here.

Kausche (G. A.). **Über eine das Virusprotein inaktivierende Substanz im Samen von Nicotiana tabacum Samsun.** [On a substance inactivating the virus protein in the seed of *Nicotiana tabacum* var. Samson.]—*Biol. Zbl.*, lx, pp. 423–428, 1940. [Abs. in *Chem. Zbl.*, cxi (ii), 23, p. 3198, 1940.]

Notwithstanding the fact that tobacco mosaic virus invades the ovaries, the virus was shown by experiments on the Samson variety at the Biological Institute, Dahlem, Berlin, to be non-transmissible by way of the seed, in which an inactivating substance is formed, both in infected and healthy plants, during the processes of ripening and germination. The substance, presumably an amino alcohol, is water-soluble, withstands the action of heat, acid, and lye, and can be precipitated with alcohol from an aqueous solution.

Van der Weij (H. G.). **Desinfectie tegen Tabaksmozaiek.** [Disinfection against Tobacco mosaic.]—*Meded. Deli-Proefst.*, Ser. 3, 6, 22 pp., 4 graphs, 1940. [English summary.]

Trisodium phosphate (8 per cent.) plus 4 per cent. copra sodium soap was found to be much the most effective of the various disinfectants tested against the tobacco mosaic virus at the Deli Experiment Station, Sumatra [*R.A.M.*, xviii, p. 765], and frequent washing of the coolies' hands in this solution should prove a valuable adjunct to the control of the disease, though it is emphasized that the timely removal of infected plants as soon as they appear constitutes the first line of defence. The other preparations tested, including 5 per cent. formalin, 0·2 per cent. potassium permanganate, 0·25 per cent. lysol, and 4 per cent. soap, were less effectual; the admixture of soap, however, enhanced the efficacy, not only of trisodium phosphate, as mentioned above, but also of sodium carbonate (the next best compound to trisodium phosphate at a strength of 10 per cent. and upwards) and formalin.

Roelofsen (P. A.). **Verslag van het Deli Proefstation over het jaar 1939.** [Report of the Deli Experiment Station for the year 1939.]—*Meded. Deli-Proefst.*, Ser. 3, 7, 79 pp., 1940.

The following items of phytopathological interest, besides those noticed from other sources, occur in this report [cf. *R.A.M.*, xviii, p. 765], a number of them being contributed by H. G. van der Weij. The average incidence of slime disease [*Bacterium solanacearum*] was 10·8 per cent., compared with 11·6 in the previous year; it is estimated that infection percentages of 10, 20, 30, and 40 per cent. represent reductions of leaf yield of 14, 27, 38, and 48 per cent., respectively.

Out of a total of 553,456 beds, 41,119 (7·4 per cent.) were ploughed up on account of slime disease. The incidence of infection in nine selected lines ranged from 6 to 13·5 per cent. compared with 21 per cent. in the control, and in some, at any rate, of the resistant strains the quality of the product approximates to the commercial standard.

In a series of experiments with various chemical compounds for the control of *Cercospora* [*nicotianae*] in the seed-bed, the best results were obtained with 0·5 per cent. Wacker's new Kupferkalk plus 1 per cent. lead arsenate [ibid., xvi, p. 230], two applications being made weekly, beginning on the 20th day after sowing, and a total of seven treatments given. The incidence of leaf spot in the beds sprayed with this mixture was 18 per cent., compared with 57 per cent. for the control plot receiving lead arsenate only, and 22·5, 21·5, and 22 per cent., respectively, for the three remaining treatments, consisting of 1 per cent. lead arsenate plus 1 per cent. Kupferkalk, 1 and 1·5 per cent. lead arsenate plus copper soap (0·6 per cent. copper sulphate and the same quantity of a 3·6 per cent. solution of copra-sodium soap). Leaf spot in the field and curing barn was effectively combated by the lead arsenate-copper soap treatment, two applications being given weekly, commencing three days after planting out and terminating at heading. At the second plucking test, the percentages of healthy, slightly spotted, and severely infected leaves in the treated plot were 49·7, 34·7, and 15·6, respectively, compared with 26, 41·8, and 32·2 per cent., respectively, in the untreated control plot. After curing, the average number of spots on 56 leaves from the treated plot was $0·39 \pm 0·086$, as against $4·14 \pm 0·39$ on 35 from the control. The practice of sowing seed in separate beds, and transplanting the seedlings at the age of 15 to 20 days to their field sites, widely adopted for convenience in slime disease resistance trials, was found to contribute in no small degree to the development of leaf spot, the direct cause of which was doubtless the interruption of growth consequent on removal. Transplanting is also known to enhance the risk of mosaic infection on soils infested by the virus, and altogether the practice should only be resorted to if absolutely inevitable.

Van der Laan (P. A.). **Motschilduis en Eupatorium als oorzaken van pseudo-mosaiek.** [White fly and *Eupatorium* as causes of pseudo-mosaic.]—*Vlugschr. Deli-Proefst. Medan*, 67, 4 pp., 1940.

In order to confirm the suspicion already entertained as to the agency of white flies (*Bemisia gossypiperda*) in the transmission of pseudo-peh sim or false mosaic in Sumatra [*R.A.M.*, xviii, p. 765], two tests were conducted in which 200 seedlings were grown under cages and 200 left exposed; at the end of three weeks, not a single plant in the cages was infected, whereas 22 and 5 per cent., respectively, of those outside in the two plots showed symptoms of the disease. In another trial in which 200 plants were grown in an isolated plot and left untouched, 17 per cent. infection developed. Further experiments, in which 20 to 30 per cent. of the young plants placed in contact with diseased weeds in the presence of *B. gossypiperda* contracted false mosaic symptoms, clearly implicated the white fly as the carrier of infection from *Eupatorium odoratum* to tobacco, 6 out of 10 plants

and 4 out of 20 plants developing the disease in two separate tests. Other weeds involved to a lesser extent in the transmission of false mosaic are *Ageratum conyzoides* and *Synedrella nodiflora*, both known to act as reservoirs of 'gilah' infection [loc. cit.]. Every effort should be made to exclude *E. odoratum* from the vicinity of tobacco plantations, which should be surrounded by absolutely weed-free strips 30 m. in width.

VAN DER WEIJ (H. G.). **1. Onbetrouwbare bibit en slijmziekte in der aanplant. 2. Kan de slijmziekte zich horizontaal door de grond verspreiden? 3. Nieuwe elementen in de braaklandflora van het Delische Tabaksgebied en hun beteekenis voor het slijmziekte-vraagstuk.** [1. Unreliable seed and slime disease in the crop. 2. Can slime disease spread horizontally through the soil? 3. New elements in the flora of fallow soils in the Deli Tobacco-growing region and their bearing on the slime disease problem.]—*Meded. Deli-Proefst.*, Ser. 3, 10, 25 pp., 5 graphs, 1940. [English summaries.]

In experiments to determine the value of steam sterilization of tobacco seed-beds as a means of combating slime disease (*Pseudomonas* [*Bacterium*] *solanacearum*) [*R.A.M.*, ix, p. 3], the incidence of mortality was compared between two or more of the following groups of apparently healthy seedlings, each comprising 400 to 500 plants in double rows in several replications and consisting of material from (*a*) diseased beds containing a few infected seedlings; (*b*) suspected beds adjacent to diseased ones but harbouring no diseased seedlings; (*c*) healthy beds in sound seed-bed complexes; and (*d*) steam-sterilized beds.

The results were as follows. Externally sound seedlings, originating in infested beds, are liable to severe attacks of slime disease in the field, commencing within 8 to 18 days of transplanting and continuing in some instances until the conclusion of harvesting; 80 per cent. of the mortality arising from this source occurs between the 19th and 43rd day from planting out. Outbreaks of infection on slightly diseased soils within three weeks of transplanting are in all probability attributable to seed-bed contamination. The development of *Bact. solanacearum* on completely healthy plants in heavily infested ground took place within 18 days from transplanting. Further tests, in which half the seedlings from a healthy bed were planted next to sound material and the other half in proximity to diseased seedlings, demonstrated the virtual absence of horizontal dissemination of the pathogen or its passage from plant to plant during an 80-day period. The value of steam sterilization was shown both by the low incidence of infection in seedlings from treated beds (roughly 4 per cent. after two months in the field) and the relative lateness of its appearance (19 to 27 days after transplanting).

In inoculation experiments with *Bact. solanacearum* from various hosts on some of the herbaceous and woody plants developing spontaneously on fallow ground during the minimum period of seven years elapsing between one tobacco crop and the next in the locality under observation, positive results were obtained on *Cynura crepidioides*, *Eupatorium odoratum*, and *Salvia privoides*.

CLAYTON (E. E.), GAINES (J. G.), SHAW (K. J.), SMITH (T. E.), & GRAHAM (T. W.). **Gas treatment for the control of blue mold disease of Tobacco.**—*Leafl. U.S. Dep. Agric.* 209, 8 pp., 2 figs., 1941.

The following recommendations are made for the control of tobacco blue mould [*Peronospora tabacina*] by means of paradichlorbenzene vapour released from crystals scattered on the surface of the regular tobacco cloth stretched 12 to 18 in. above the ground, the beds being covered over with a 60- to 65-thread muslin weighing about 4½ oz. per sq. yd. [*R.A.M.*, xix, p. 733]. No. 6 grade paradichlorbenzene should be used, though a smaller grade is rather more satisfactory in very cool weather, and a larger one during a warm spell. If the muslin cover is dry or somewhat moist 2½ to 3 lb. per 100 sq. yds. of bed should be used, but if it is watersoaked 1½ lb. suffice. Treatment should begin just before sunset (earlier in cool, later in warm, weather) and the beds should be opened at 8 a.m. The first application should be made directly infection is observed in the beds or in neighbouring ones, and should be repeated twice weekly, but not on two consecutive nights, the longest period allowed to elapse between treatments being not over four days. In cold weather three treatments per week should be given. In general, five to ten treatments have been found necessary each season.

MOORE (E. S.). **Control of the kromnek (spotted wilt) disease of Tomatoes.**—*Nature, Lond.*, cxlvii, 3729, pp. 480–481, 1941.

In preliminary trials made in South Africa very promising results in the control of tomato kromnek [*R.A.M.*, xx, p. 150] were given by tartar emetic (1 lb., plus 2 lb. sugar per 100 gals. water), used against the vector *Frankliniella schultzei*. Spraying was begun in the outdoor seed-bed in October, when the plants were in the cotyledonary stage and were already being attacked by the insect, and was repeated at frequent intervals during the next nine weeks. In the neighbouring unsprayed control beds the plants showed the disease when only 4 in. high, and became 100 per cent. infected, growth at once ceasing. In the sprayed beds not more than 5 per cent. of the plants became infected, and an abundant crop was obtained.

ELTINGE (ETHEL T.). **Effect of manganese deficiency upon the histology of Lycopersicum esculentum.**—*Plant Physiol.*, xvi, 1, pp. 189–195, 3 figs., 1941.

A study of the histology and cytology of tomato plants growing in nutrient solution and affected with manganese deficiency showed that the chloroplasts are the first part to become affected. They turn yellow-green, lose their starch grains, become vacuolated, later granular, and finally disintegrate along with the cytoplasm, which turns brown. Affected leaves are thinner and have smaller palisade cells than normal ones; they contain many more cells which show larger masses of crystals than do normal leaves, as do the parenchyma cells similarly. Affected stems are thinner and contain less xylem than normal ones, and often show xylem cells plugged with coagulated material. Some of the conducting cells in the veins of affected leaves are also plugged, clogging being due here to both crystals and coagulated material.

SUMSTINE (D. R.). **Notes on some new or interesting fungi.**—*Mycologia*, xxxiii, 1, pp. 17–22, 1941.

This annotated list contains 14 species from the United States, of which two are new to science. *Microsphaera platani* Howe attacking both the young and the older leaves of the oriental plane tree (*Platanus*) [*acerifolia*] was collected in six localities, and at Overbrook, Philadelphia, the fungus has become a menace to shade trees. The conidial stage is distinct from *Oidium obductum*, and the perfect stage, found at Camden, New Jersey, is considered by some to be a form of *M. alni* (Wallr.) Salmon.

BAILEY (H. E.). **Contributions to the biology of Polyporus rheades (Pers.) Fries.**—*Bull. Torrey bot. Cl.*, lxviii, 3, pp. 198–201, 2 figs., 1941.

*Polyporus rheades* is stated to be of common occurrence in California, where it causes a destructive white-piped rot of oak. It is particularly prevalent in the vicinity of Mount Diabolo, Contra Costa County, where sporophores have been found on several species of oak, *Quercus wislizenii*, *Q. lobata*, and *Q. douglasii* being those most severely attacked.

Sporophore formation generally takes place between September and November, scarcity at other times possibly being due to insect attack. In nature, sporulation may be very copious. Sporophores produced in culture cast spores abundantly, some for 30 days; the spores shed during this period in one culture weighed over 100 mg. (air-dry weight). Spore germination under laboratory conditions was erratic and the percentage was low. It occurred, however, to the extent of about 15 per cent. in a malt extract medium in which the mycelium had been grown.

When blocks of *Q. agrifolia* exposed to infection were kept in a damp chamber at 25° C. the wood became progressively lighter, and in advanced stages had a bleached appearance, with thin, dark, zone lines passing irregularly through it. The rotted wood was stringy, soft, and spongy, and could easily be torn apart with the fingers. Chemical analyses showed that as samples were taken at successive intervals there was a progressively greater utilization of each of the wood components by the fungus.

TEHON (L. R.) & HARRIS (H. A.). **A Chytrid inhabiting xylem in the Moline Elm.**—*Mycologia*, xxxiii, 1, pp. 118–129, 14 figs., 1941.

The discovery of a Chytrid in 1932 on a diseased Moline elm at Madison, Wisconsin, lead to the establishment of a new genus, *Carpenterella*, to include this Chytrid, named *C. molinea* [with Latin diagnoses for both the new genus and species], and possibly the very similar, as yet unnamed organism described by Carpenter [see above, p. 276] on sugar-cane. All attempts to isolate the organism in culture failed, but spherical bodies found in discoloured sections of the wood are believed to be oospores, and primitive thalli were observed in xylem cells. Cultural trials and microscopic examination failed to show the presence of any other organism in the diseased elm, but there is no conclusive evidence as to the Chytrid being the cause of the disease. Its occurrence within the elm, however, suggests that

Chytridiaceous organisms can invade tissues in the trunk and branches of woody plants and might possibly assume there the roles of parasites or commensals.

HIRANE (S.). **Studies on the parasitism of the rust of Acacia confusa Merrill, Maravalia hyalospora (Saw.) Diet. III. A cytological study of different regions of phyllodes with varying degrees of resistance to urediospore infection.**—*Ann. phytopath. Soc. Japan*, x, pp. 171–185, 2 pl., 1940. [Japanese, with English summary.]

In further studies on the mode of infection of *Acacia confusa* by *Maravalia hyalospora* in Formosa, Japan [*R.A.M.*, xviii, p. 489], both the very young, rapidly growing, and mature, fully developed portions of the phyllodes were found to afford unfavourable conditions for the development of the parasite, which can only pursue its normal course in the regions of intermediate age and activity. It would appear from these observations that the resistance opposed by the host tissues to *M. hyalospora* is of a protoplasmic nature.

IVANOFF (S. M.) & IVANOVA (Mme V. I.). О причине гибели отдельных деревьев Тунга Фордии. [On the cause of dying of some trees of Tung Fordii.]—*Sovetsk. Subtrop., 1940*, 10, pp. 26–31, 8 figs., 1940.

In the spring of 1939 a drying up of a few tung Fordii trees [*Aleurites fordii*] was observed on plantations in the Georgian S.S.R. The next spring, after a more severe winter, approximately 5 per cent. of the trees, comprising the most vigorous and fertile, were affected along the Black Sea littoral of the Caucasus, and a loss of 20 per cent. of the entire tung production of 1940 resulted. The condition is believed to be identical with bronzing [*R.A.M.*, xvii, p. 781] or due to some similar physiological factor. The symptoms, which varied widely, included an abnormal dark bronzing of either the entire lower surfaces of leaves or parts of them. Sometimes a velvety, brownish film, seen under the microscope to consist of very fine hairs, was observed on the lower surfaces of leaves, while the upper surfaces were light green. Later, necrotic spots developed and the leaves became curled and dropped, or turned yellow and dropped without developing necrosis. The bronze colour on the rosette leaves disappeared entirely or partly as the season advanced, the new leaves showing the characteristic velvety film and being often deformed. Chlorosis, resembling frenching [loc. cit.], was exhibited by some trees, accompanied, in severe cases, by shortened leaf stalks and stunted leaves.

GREGORY (J. N.). **X-rays and timber defects.**—*J. Coun. sci. industr. Res. Aust.*, xiii, 4, pp. 310–312, 4 pl., 1940.

Most of the major defects, including decay and gum pockets, in eight wooden poles were clearly shown up by the application to sections 12 to 18 in. in length of X-rays [*R.A.M.*, xviii, p. 563], the negatives of which provided useful data in the examination of the faulty material. The method is considered to carry definite commercial possibilities, especially for the non-destructive analysis of the timbers used in the erection of bridges and other large structures, the removal of which

on the grounds of mere suspicion of internal rotting would thus be obviated: for ordinary purposes its use is likely to be restricted by considerations of expense.

Despeissis (J. L.). **A preliminary investigation of blue-stain in 'kauvula' timber.**—*Agric. J. Fiji*, xii, 1, pp. 23–25, 1941.

'Kauvula' (*Endospermum* spp.) timber in Fiji, used for making butter boxes, is commonly affected under Australian conditions by blue stain [*R.A.M.*, xix, p. 507], due to *Ceratostomella* spp. As timber with a moisture content of under 20 per cent. of its dry weight is unaffected, the timber is steamed, to expedite seasoning, as well as to deodorize it. The standard practice at the Walu Bay timber yard is to treat with a cold solution of 5 per cent. borax for several seconds. Results are moderately satisfactory, but blue stain still occurs to some extent.

Findlay (W. P. K.). **Effect of addition of sugar on rate of decay of wood.**—*Ann. appl. Biol.*, xxviii, 1, pp. 19–22, 1941.

Experiments are described, the results of which indicated that the addition of small amounts of sucrose had little effect on the loss in weight of wood invaded by *Lentinus lepideus*, *Coniophora cerebella* [*C. puteana*], or *Polystictus versicolor*. Where the concentration of sucrose solution was 5 per cent., the loss in weight (the weight of the sugar absorbed being disregarded) was in every case less than that of the controls. In a second experiment with *Merulius lacrymans*, *C. puteana*, *Poria vaillantii*, and *Lenzites trabea*, and using 1 and 2·5 per cent. dextrose, a similar result was obtained. Thus, there was no evidence that the addition of dilute solutions of sucrose or dextrose stimulated the growth of the test fungi in such a way as to increase their wood-destroying capacity. In fact, *Lentinus lepideus*, *C. puteana*, *M. lacrymans*, and *P. vaillantii* appeared to cause less destruction in the presence than in the absence of added sugar. These organisms probably utilize the more readily available carbohydrates rather than the polysaccharides, with the result that once the former have been consumed, decay proceeds at about the same rate as in untreated wood. For instance, the loss in weight in control blocks due to *C. puteana* after five weeks was 4·7 per cent. more than in the blocks with 5 per cent. sucrose (no allowance for weight of sugar), and after ten weeks was 4·1 per cent. more. With *Polystictus versicolor*, after five weeks the controls had lost 2·8 per cent. more in weight than the blocks treated with 5 per cent. sucrose, and after ten weeks 3 per cent. more. Evidently, treatment with a 5 per cent. solution of sucrose has no appreciable preservative effect; very much greater concentrations of sugar would be required to raise the osmotic pressure of the solution enough to inhibit fungal growth therein.

These results support Gäumann's view [cf. *R.A.M.*, xvi, p. 354] that variations in the content of soluble carbohydrates do not substantially affect the liability of wood felled at different seasons to decay by wood-rotting organisms, and that differences observed are due to variations in the condition of the cell walls.

Woodman (R. M.). **The nutrition of Turnips.**—*Ann. appl. Biol.*, xxviii, 1, pp. 1–7, 1 pl., 1941.

The results of experiments [which are described in detail] on the influence of variations in the supply of inorganic nutrients on the growth of turnips in sand in pots under greenhouse conditions demonstrated, *inter alia*, that potassium deficiency led to a grey-green scorch, foliage limpness, and leaf drop, though yield was not greatly diminished until a rather low level of available potassium was reached. Absence of boron caused foliage wastage and finally induced the death of the plant, the turnips being tiny, rough-sided, and with a tendency to rot. The presence of 0·0681 p.p.m. of boron, as borax, gave normal plants.

Coons (G. H.) & Stewart (D.). **U.S. 200×215, a new Beet variety resistant to leaf spot.**—*Sug. J., Louisiana*, iii, 2, pp. 7–10, 1940. [Abs. in *Int. Sug. J.*, xliii, 508, p. 123, 1941.]

The release of the U.S. 200×215 sugar beet variety, which is reliably claimed to be resistant to leaf spot [*Cercospora beticola*], is regarded as particularly timely in view of the emergency situation arising out of the European war conditions and involving the cessation of importation of foreign seed by the farmers of Michigan, Ohio, Indiana, and other States of the American Union.

Wood (F. C.). **Note on Xylaria vaporaria: an invader of Mushroom beds.**—*Gdnrs' Chron.*, Ser. 3, cix, 2831, p. 131, 1941.

The author reports that since 1935, *Xylaria vaporaria* [*R.A.M.*, xiv, p. 555; xix, p. 617] appears to have become much less common in cultivated mushroom [*Psalliota* spp.] beds in England, presumably because of improved sanitary methods. With floor beds, the usual practice, before laying down the compost, is to flood the glasshouse soil with one of the proprietary cresylic acid preparations, after easing the soil with a fork. The compost is generally partially cured beforehand outside the glasshouse under a Dutch barn, and for the last stages is fumigated in the house with sulphur dioxide when fermentation heat is greatest. Further, most growers use pure culture spawn, and also sterilize the casing soil.

S. (J. M.). **The preparation of Mushroom compost.**—*Gdnrs' Chron.*, Ser. 3, cix, 2829, p. 116, 1941.

Detailed instructions are given for the preparation of mushroom compost from strawy stable manure from corn-fed horses in hard work.

Springensguth (W.). **Die Kultur des Manioks, seine Krankheiten und Schädlinge im Litoral des Staates St. Catharina (Brasilien).** [Cassava cultivation, its diseases and pests on the coast of the State of Santa Catarina (Brazil).]—*Tropenpflanzer*, xliii, pp. 286–306, 1940. [Abs. in *Chem. Zbl.*, cxi (ii), 23, p. 3248, 1940.]

Cassava seed destined for cultivation along the coast of the State of Santa Catarina, Brazil, should undergo disinfection against *Fusarium*, while *Cercospora* [? *caribaea: R.A.M.*, xvii, p. 651] should be combated by spraying the plants with Bordeaux mixture plus arsenic. An interval of at least three years should elapse between successive plantings of the

crop, to the health of which natural and synthetic fertilizers, especially potash, are indispensable. Stems and foliage should be burnt after the harvest.

DUNNE (T. C.). **Wastage in export Grapes. Preliminary studies with potassium metabisulphite.**—*J. Dep. Agric. W. Aust.*, pp. 439–443, 1940. [Received April, 1941.]

In preliminary, small-scale experiments carried out in Western Australia in 1940 on the prevention of fungal wastage in stored export Ohanez grapes [cf. *R.A.M.*, xix, p. 286] 40- and 100-mesh potassium metabisulphite was used at the rates of 5 and 10 gm. per case of fruit, the cases being only half-packed, but made to contain about 30 lb. of fruit. The preservative was mixed with the granulated packing cork immediately before packing; where it was applied 'top and bottom', half the quantity was spread on the paper before packing, and the remainder was spread over the top layer of cork. All packing was carried out in the field.

In the first test, fruit was used from a vineyard in which in 1939 considerable wastage had occurred from *Penicillium* moulds. Some of the cork used in the test was contaminated. Packing was effected on 29th March, the cases were placed in cool storage next day, and separations of rotted berries were made on 18th and 20th July. Two cases were used for each treatment. At the second separation the two cases treated with 5 gm. of the chemical (40-mesh) had, respectively, 3·8 and 9 per cent. rotted berries (by weight) for the two separations together, the corresponding figures for the 10 gm. treatment (40 mesh) being 3 and 5·4 per cent., for 10 gm. applied top and bottom (5 gm. each, 40-mesh) 17·1 and 8·9 per cent., and for the controls 54·1 and 50 per cent.

In the second test the fruit was obtained from a vineyard severely affected by *Botrytis cinerea* in 1939. All the grapes were sprayed with a spore suspension of this fungus shortly before packing. The fruit was packed and placed in cool storage on the same dates as in the first experiment, and separations were made on 30th June and 3 days later from one case and 1st August and 3 days later from the other. With 5 gm., 40-mesh, the second case (figures were not obtained for all the cases) totalled 7·7 per cent. rotted berries for the two separations; with 10 gm. 40-mesh, the two cases totalled, respectively, 4·2 and 4·4 per cent. rot; with 2 gm., 100-mesh 8·2 and 27·4 per cent.; with 5 gm., 100-mesh 5·2 for one case; with 10 gm., 100-mesh 4·6 and 6·1; with 10 gm., 40-mesh (5 gm. each top and bottom) 5·7 and 2·8; and with 5 gm. each top and bottom large crystals (one case only) 23·2 per cent., the figures for the untreated controls being 24·3, 29·6, and 59·2 per cent. Control thus resulted in every instance, except where only 2 gm. of the chemical or large crystals were used.

DEL CAÑIZO (J.). **Los tratamientos del Viñedo (datos practicos).** [Vine treatments (practical data).]—*Bol. Pat. veg. Ent. agric., Madr.*, ix, pp. 67–71, 1940.

The author has collected data from collaborators in various parts of

Spain concerning the application of disinfectant treatments against vine pests and diseases. Downy mildew (*Plasmopara viticola*) is combated in the Rioja vineyards by four applications of Bordeaux mixture, the first when the racemes emerge from the buds, the second 10 to 18 days later, the third at blossom formation, when racemes and leaves should be sprayed separately, and the fourth (to be omitted in seasons of mild infection) 20 to 25 days thereafter. The consumption of the fungicide is estimated as 224, 490, 1,540, and 910 l. per ha., respectively, making a total of 3,164 l. per ha. In the experimental vineyards of Navarra, the corresponding amounts of Bordeaux mixture consumed are 333, 775, 1,200, and 1,283 l. per ha., making a total of 3,591 l. In this region a fifth treatment with a copper dust is sometimes requisite. Four treatments at least, and six or more in years of severe attack, are given in the viticultural district of Panadés (Barcelona), the first in the early days of May, when the buds are 20 cm. in length, the second during the first fortnight of June, the third in the latter half of the same month, and the fourth in mid-July, the supplementary sprays being applied, when necessary, at 10- to 12-day intervals. In normal seasons the quantity of copper sulphate consumed per 1,000 stocks is 12 kg.

Espalier vines may be treated by means of the 6 h.p. Holder Autofix gasoline-oil motor sprayer, with a charge of 300 l., working at a pressure of 25 atmospheres. The apparatus can be operated by one man, and under the planting conditions obtaining in Murcia an area of 5 ha. is covered in the course of an eight-hour day. Using a Vermorel or Perrás knapsack sprayer, 15 men can treat an area of 12·5 ha. in an eight-hour day in the same vineyard.

Three applications of sulphur are normally given in the Rioja for the control of *Uncinula necator*, the first generally about the middle of May, the second when the vines are in full flower, and the third when the leaves of susceptible varieties (Muscatel, Viura, and Mazuelo) begin to contract. Using a Torpille (Vermorel) knapsack sprayer, the quantities of sulphur consumed at the first, second, and third treatments are 8·4, 24·5, and 35 kg. per ha., respectively. In Navarra, where four treatments are applied, the average sulphur consumption during a six-year period was 10·4, 20·2, 25·9, and 27·9 kg. per ha., respectively, one man covering 120 to 160 stocks per hour. By means of the Aquilón horse-drawn apparatus (Vermorel), discharging 15 to 400 kg. sulphur per hour, 12 ha. may be treated in an eight-hour day under the system of espalier planting practised in Murcia.

Costa (F.). **Regiões infestadas pela bacteriose da Mandioca.** [Regions infected by the bacteriosis of Cassava.]—*Biologico*, vi, 11, p. 332, 1940.

An Order of the Minister of Agriculture of Brazil, dated 30th October, 1940, prohibits the sale of cassava cuttings from the following States infected by bacteriosis (*Bacillus manihotus*) [*R.A.M.*, xvii, p. 650]: Espirito Santo, Rio de Janeiro, São Paulo, Paraná, Santa Catarina, Rio Grande do Sul, Minas Gerais, Goiaz, and Matto Grosso; excepted from the regulation are small quantities of certified material of resistant varieties.

IMPERIAL MYCOLOGICAL INSTITUTE

# REVIEW
OF
# APPLIED MYCOLOGY

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Zillig (H.). **Praktische Ergebnisse phänologischer Beobachtungen am Moselriesling (Vitis vinifera) und seinen Feinden.** [The practical results of phenological observations on the Moselle Riesling (*Vitis vinifera*) and its enemies.]—*Wein u. Rebe*, xxii, pp. 193–212, 1940. [Abs. in *Chem. Zbl.*, cxi (ii), 22, p. 3092, 1940.]

Systematic observations covering a period of 28 years on Riesling vines in the valley of the Moselle have led the writer to the following conclusions. Since the new foliage is often formed as early as the second half of April, the overwintered leaves, harbouring *Peronospora* [*Plasmopara viticola*], 'roter Brenner' [*Pseudopeziza tracheiphila*], and other pathogens, should be dug under by the middle of the month at the latest. Post-blossom treatments against *Plasmopara viticola* should be initiated during the first three weeks of July, following the cessation of flowering at the close of June or early July. Infection by *Oidium* [*Uncinula necator*] appears from 20th May onwards, while the middle of the same month is the earliest date for an outbreak of downy mildew. Prophylactic treatments should be planned accordingly.

McDougall (J. C.). **Report of the working of the Department of Agriculture in the Central Provinces and Berar for the year ending 31st March, 1940.**—30 pp., 1941.

In the section of this report [cf. *R.A.M.*, xviii, p. 372] dealing with mycology (pp. 9–10), it is stated that two years' experiments have demonstrated that while exposure of juar [sorghum] seed to the summer sun helps appreciably to control grain smut [*Sphacelotheca sorghi*], it does not dispense with the necessity for the fungicidal dusting of infected seed. The evidence obtained indicated that the spores of the head smut form (*Sorosporium reilianum*) do not long remain viable in infected soil. Potted soil inoculated with the fungus in 1937 gave 37 per cent. infected heads; in 1938 the figure was reduced to 3, and in 1939 all the cobs were healthy. Field experiments gave less conclusive results, but even in these the incidence of smutted heads declined.

Three years' experiments on wheat loose smut (*Ustilago tritici*) demonstrated that the summer temperature in Nagpur is not sufficiently high, as it is in the Punjab, to kill the dormant mycelium in the seed, but that soil conditions at sowing time are such as to retard the

development of the dormant mycelium in the seed and the infection of the seedling.

The spraying of ground nuts against 'tikka' disease [*Cercospora personata*: ibid., xviii, p. 373] with Bordeaux mixture and added linseed oil gave considerable increases in yield, even in crops not contracting the disease.

Citrus pink disease (*Corticium salmonicolor*) causes progressively greater damage every year. The mycelium remains dormant in the cankers and becomes active when moist conditions prevail. The systematic removal of all diseased branches is essential, and spraying with Bordeaux mixture reduces further infection. Mango and jackfruit [*Artocarpus integrifolia*] are sources of infection.

The predominant fungus isolated from 'black blotch' lesions on sann-hemp [*Crotalaria juncea*] was *Fusarium* sp. This organism and others isolated from the dead parts of the bark failed, however, to infect healthy tissues, and blackening of the bark is primarily attributed to the action of water; the fungi infect the tissues through the blackened areas and destroy the fibres.

PARK (M.). **Report on the work of the Division of Plant Pathology.**—*Adm. Rep. actg Dir. Agric., Ceylon, 1939*, pp. D 20–D 22, 1941.

Apart from information noted from other sources the following items of interest occur in this report [cf. *R.A.M.*, xix, p. 260]. In one test, the Marglobe tomato variety gave 4,883 more plants affected by bacterial wilt [*Bacterium solanacearum*] per acre than a local variety produced from mass selections at Talatuoya and later at Peradeniya. The two varieties showed, respectively, 81·5 and 47·9 per cent. wilt. Roguing failed significantly to reduce the incidence of the disease. Further selection work is in progress.

The experimental campaigns against bunchy top of plantains [ibid., xx, p. 171] (which were concluded) indicated that incidence can be very considerably reduced, but complete eradication would be expensive and would take many years. Every effort should be made to persuade growers to undertake treatment themselves. Further eradication work was carried out at Minneriya and Tissamabarama; in localities such as these, where infection is not extensive and re-infection from outside sources unlikely, intensive eradication campaigns are valuable and may prove completely successful.

An exceptionally severe outbreak of sclerotial disease of rice, due to a strain of *Rhizoctonia* [*Corticium*] *solani*, occurred in one area.

In 1936, Surat ginger imported from India and planted in Ceylon became attacked by *Pythium myriotylum* [ibid., xvii, p. 294]. The ginger was destroyed, except in one small area, which was kept under close supervision. From these plants, a small quantity of clean ginger was established, which has remained unaffected for two seasons.

New disease records for Ceylon observed in 1939 included *Trichosporium vesiculosum* on *Casuarina equisetifolia*, *Ustulina zonata* on *Citrus aurantifolia*, *Diaporthe citri* on grapefruit, (?) *Uromyces sojae* on soy-bean, *Ovulariopsis moricola* on mulberry, *Coniothecium chomatosporum* on apple, and *Cercospora melongenae* on eggplant.

WIEHE (P. O.). **Division of plant pathology.**—*Rep. Dep. Agric. Mauritius, 1939*, pp. 10–14, 1941.

In this report on plant disease work in Mauritius in 1939 [cf. *R.A.M.*, xix, p. 261] the author states that inoculations of the spindles of young coco-nut palms with a suspension of *Bacterium vasculorum* [from sugar-cane] gave positive results. The first record of *Bact. albilineans* [cf. ibid., xix, p. 729] on SC 12/14 sugar-cane was made at Mon Désert sugar estate, Moka. Dry conditions early in the year strongly favoured sugar-cane smut (*Ustilago scitaminea*) [ibid., xix, p. 583] in low-lying districts, especially in the north and at Grand Port. The most severely affected cane was B.H. 10/12. Ratoon suffered more than virgin cane, and in some instances many stools succumbed. M. 171/30 was also affected in these localities. Three-months-old virgin D.K. 74, B.H. 10/12, and White Tanna canes were successfully inoculated in the field by injuring the roots with a knife and mixing broken-up infected heads with the soil, 73 per cent. of the stools being infected, while the controls remained healthy. In another experiment, farmyard manure was applied (*a*) in the interlines and (*b*) on the stool, and the plots averaged 36 and 12 per cent. infection, respectively.

Investigation of an outbreak of *Colletotrichum falcatum* [ibid., xviii, p. 344] on virgin M. 134/32 canes showed that in every instance the fungus had effected entry through borer galleries.

A study of the effect of potassic fertilizers on intensity of infection by *Helminthosporium ocellum* [*H. sacchari*: ibid., xi, p. 4; xii, p. 722] on B.H. 10/12 gave inconclusive results, 9·1 per cent. of the area of the third leaf being infected in the treated plot and 9·7 per cent. in the controls. A similar experiment with complete fertilizers, potash being omitted, also gave inconclusive results.

A comparative study of root failure on P.O.J. 2878 and D. 130 (a variety which was taken out of cultivation because of its susceptibility) showed that in both varieties destruction of the root system was induced by the same factors, viz., *Anguillulina similis* in combination with weak parasites including *Fusarium* spp., *Rhizoctonia* spp., and *Pythium* spp. [ibid., xix, p. 728].

A suspected outbreak of chlorotic streak [ibid., xix, pp. 237, 432; xx, p. 276] occurred on virgin B.H. 10/12 cane at Mon Désert and Mon Trésor sugar estate (Grand Port). A trial was later laid down to study the effect of hot water treatment on infected cuttings.

Wilt of *Calophyllum inophyllum* was caused by a fungus identified as a new species of *Haplographium*. Healthy trees experimentally inoculated developed symptoms of wilt in six weeks, and two weeks later were all dead. The fungus was reisolated from the affected wood, and in dead trees the entire sap wood was found to be completely permeated by hyphae. Positive results were also obtained from inoculations on *Mimusops maxima* and *Eugenia glomerata*, but the progress of infection was slow. Stem rot of *Calophyllum* [*inophyllum*] has so far been observed only in one locality. The cause was proved to be *Geotrichum candidum* [ibid., xvi, p. 575].

*Wickstroemia indica* in a number of districts was killed off by wilt due to *Phytophthora parasitica*.

**Plant diseases. Notes contributed by the Biological Branch.**—*Agric. Gaz. N.S.W.*, lii, 2, pp. 100–104, 4 figs., 1941.

Smut (*Ustilago zeae*) was first recorded on a commercial maize crop in Australia at George's Plains, near Bathurst, in May, 1938. The diseased crop was cut out by hand and carefully burned, and the owner of the property agreed to plant no more maize for a number of years. A year later, however, the disease was found on six other farms in the locality, and in 1940 on three more near Bathurst. Infection is at present confined to this district, and every possible effort is being made to prevent its introduction in the chief maize-growing areas of New South Wales. Maize is not an important crop at Bathurst, and its further cultivation locally is being discouraged. Action has also been taken to ensure that maize is not again grown on farms that have been affected.

Potato blackleg (*Erwinia phytophthora*) was first recorded in New South Wales in 1932, but was probably present many years before. It occurs in all the chief potato-growing areas of the State, and under warm, wet conditions may cause appreciable losses. The control measures recommended are as follows. Seed tubers should be taken from healthy plants, or, preferably, from crops in which the disease has not occurred. Any crop intended for seed purposes should be thoroughly rogued during the growing season for all diseases producing any symptoms on the above-ground parts. Rotation should be adopted, potatoes being planted only once every three or four years. All diseased plants and tubers should be burnt. The seed tubers should be treated before planting with acidulated mercuric chloride. When cutting tubers before planting, the knife should be disinfected if a diseased tuber is cut, and the tuber itself destroyed. During transit or storage the potatoes should be kept in cool, well-ventilated conditions.

Gardner (M. W.). **Alfalfa, Sugar Beet, and Tomato diseases observed in Mexico.**—*Plant Dis. Reptr*, xxv, 3, p. 99, 1941. [Mimeographed.]

Early in January, 1941, N. Stahler detected the presence of *Pseudopeziza medicaginis* and *Peronospora trifoliorum* on lucerne, *Uromyces betae* on sugar beet, and *Bacterium vesicatorium* on tomato in various localities in Mexico.

Cochran (L. C.). **A case of the crown gall organism persistent in grain land.**—*Plant Dis. Reptr*, xxv, 2, p. 73, 1941. [Mimeographed.]

Circumstantial evidence is adduced for the infection by way of the soil of seedling and transplanted *Prunus* nursery trees by crown gall (*Phytomonas* [*Bacterium*] *tumefaciens*) on a site near the Citrus Experiment Station, Riverside, California, that had been alternately summer-fallowed and used for grain crops for upwards of 40 years.

Mehta (K. C.). **Further studies on cereal rusts in India.**—*Sci. Monogr. Coun. agric. Res. India*, 14, vii+224 pp., 12 pl., 4 maps, 3 diags., 1940.

The results of the writer's further intensive studies on the cereal rusts of India [*R.A.M.*, xviii, p. 511] are fully described and tabulated. Besides the four physiologic races of *P. graminis tritici* already reported (15, 40, 42 [given in error as 41 in *R.A.M.*, xii, p. 500], and 75), two

more have been found since 1933, namely, 21 and 24, of which the former has been encountered only once and the latter is somewhat rare. Out of 586 collections investigated during the period covered by the present instalment, 163 were mixtures of two or more races. Race 42 is the most prevalent of the six under observation and 15 the most virulent. *P. g. avenae* was detected for the first time in the country in the course of the current survey, the Nilgiri hills being apparently the only area yet involved. The ten collections examined consisted of races 3, 4, 6, and 7. The six races of *P. triticina* found up to the present in India are 10, 20, 63, A, B, and C, of which the three last-named have not been reported from any other country and are stated in a footnote to have been assigned international numbers 106, 107, and 108, respectively: 63 predominates, followed by 20 (the most virulent), 10 is fairly common, 107 rare, while 106 and 108 were identified only thrice and twice, respectively. Out of 408 collections of the rust analysed, 117 were mixtures of two or more races. The four last-named of the following eight races of *P. glumarum* derived from 236 collections are new: 13, 19, 20, 31, A, D, E, and F; all were taken from wheat, except 19, which was obtained from barley. Races A and 19 are fairly widely distributed, followed in order of prevalence by 31, the remainder being of more or or less restricted distribution. Out of 236 collections examined, 45 were ascertained to be mixtures of two races each. All the physiologic races found on wheat were proved to be capable of attacking Fong Tien barley while race 19 was pathogenic to wheat. *P. g. secalis* has not hitherto been encountered in India, but *P. g. tritici* is weakly parasitic on rye.

*Berberis* and *Thalictrum* spp., the alternate hosts of *P. graminis* and *P. triticina*, respectively, are confined to the hills. In addition to *B. vulgaris*, which was used as a control in inoculation experiments but does not occur naturally in India, the following common indigenous species were infected: *B. lycium* (mild to severe), *B. aristata* and *B. coriaria* (leaves up to the age of three days only), *B. petiolaris*, and *B.* (?) *umbellata*, the two last-named being highly resistant. As regards the relation of barberries to the infection of wheat by *P. graminis tritici*, there is no case on record or any evidence available of an outbreak of black rust originating from this source. Unlike the conditions in temperate climates teleutospores represent the summer stage of the parasite. Normally germinable teleutospores are scarce from crops over the greater part of the area under wheat and barley, even in the hills, owing to their formation in or subsequent exposure to the high temperatures of April to June. The disease has been observed to develop year after year in the plains as early as December or January, i.e., three to four months before the earliest possibility of barberry infection in the hills. The local infection of barberries in the hills therefore cannot possibly constitute a sufficient source of epidemics in the plains to warrant the immense cost of their eradication, notwithstanding which outbreaks of the rust would continue unabated through the agency of uredospores over-summering in the hills. The restricted number of races of the rust found in India indicates that infection of barberries is not of frequent occurrence. Moreover, such teleutospore infection of barberries as may occur in elevated positions during the early part of the monsoon (June

to July) is unlikely to have much importance for the wheat and barley crops that are ready for harvest by that time.

In inoculation experiments with *P. triticina* on *T.* spp., the two native species, *T. javanicum* and *T. foliosum*, in addition to the highly susceptible *T. flavum* (of foreign origin), were attacked, the first-named only weakly. Two other foreign species, *T. delawayi* and *T. minus*, and the indigenous *T. neurocarpum* reacted merely by spermogonial production. The considerations set forth above regarding the relation of barberries to black rust are similarly applicable to that of *Thalictrum* to the spread of brown rust on wheat, which is effected primarily through the agency of uredospores persisting over summer in the hills. These organs have been found to be capable of surviving both the summer and winter at altitudes of nearly 7,000 ft. in the case of all three wheat rusts.

Pending the development of one or more wheat varieties able to withstand the attacks of *P. g. tritici*, *P. triticina*, and *P. glumarum*, the following methods of minimizing the immense losses, averaging Rs. 60,000,000 [£4,500,000] or so per annum, from rust epidemics are suggested: rigorous destruction of self-sown plants and tillers, on which the organisms are perpetuated, a month or two before sowing in the hills; in respect of Peninsular India, suspension of the first (April to June) wheat and barley crops (about 3,400 acres) in the Nilgiri and Palni hills (the source of inoculum for crops covering over 2,000,000 acres for wheat alone in the Hyderabad State and a considerable part of Bombay-Deccan), and postponement to a later date of the wheat crop normally sown in July or August in the Chitaldroog and Bellary districts; and with regard to the Indo-Gangetic plain, the largest tract under wheat cultivation, the prohibition of wheat and barley sowings during August and September in Nepal, where delay until October or November should reduce the amount of inoculum in this very dangerous focus of infection.

Straib (W.). **Über die Wirkung organischer Verbindungen als Spritzmittel gegen Rostpilzinfektion.** [On the action of organic compounds as sprays against rust fungus infection.]—*Zbl. Bakt.*, Abt. 2, ciii, 6–8, pp. 74–80, 1941.

In greenhouse experiments at the Gliesmarode (Brunswick) branch of the Biological Institute on the internal therapeutic control of cereal rusts (*Puccinia* spp.), flax rust (*Melampsora lini*), and *P. antirrhini* by spraying the seedlings shortly before, immediately after, or some days after inoculation with picric acid, ortho- and para-toluolsulphonamide [*R.A.M.*, xix, p. 464], acridin, and 0·2 per cent. borax, the first-named proved to be the most effective of the substances tested for the end in view. As a result of preliminary germination tests with uredospores, evidence is adduced pointing to the acidity of picric acid as the determining factor in its toxicity to the fungi under investigation, but the fungicidal effects of ortho- and para-toluolsulphonamide and acridin, which were exerted independently of the hydrogen-ion concentration of the medium, evidently rest on some specific inherent attributes of the substances in question. Picric acid and acridin (both at 0·1 per cent.) destroyed all the cereal rust spores in 24 hours at 20° and 14°, whereas 0·4 per cent. para-toluolsulphonamide was completely effective only

against *P. glumarum tritici*, and 0·2 per cent. borax permitted 20 per cent. germination of *P. anomala*.

Spraying with 0·1 per cent. picric acid immediately after inoculation gave absolute control of *P. g. tritici* race 7, *P. graminis tritici* strain X–20, and *P. triticina* race 11 on Michigan Amber wheat, of *P. secalina* on Petkus rye, and of *P. anomala* on Fong Tien barley, while semi-complete elimination of rust pustules was also effected by the same means with *P. coronata*. Applications two or four days after inoculation were less successful. Para-toluolsulphonamide (0·4 per cent.), when applied immediately after inoculation, was completely toxic to *P. triticina* and reduced infection by *P. secalina* to a minimum, *P. g. tritici* and *P. secalina* also being effectively combated by 0·4 per cent. ortho-toluolsulphonamide. *P. glumarum tritici* and *P. secalina* yielded to treatment with 0·4 per cent. acridin, which was also moderately successful against *P. graminis tritici*, *P. triticina*, and *P. coronata*.

Both the sulphonamides and acridin tended to injure the foliage of the treated plants at fungicidal concentrations, while picric acid, though generally less harmful in this respect, may severely damage certain plants, e.g., *Antirrhinum majus*.

Hassebrauk [ibid., xix, p. 464] failed to secure control of the cereal rusts by internal therapy in his field experiments with picric acid and the sulphonamides, and it is as yet impossible, on the basis of the present greenhouse trials, to forecast the commercial possibilities of spraying with these compounds. The method would not in any case be practicable with cereal rusts, but might come into consideration with crops like asparagus [against *P. asparagi*] as a substitute for Bordeaux treatments. The utility of the toluolsulphonamides, however, must necessarily be limited by their unfavourable chemotherapeutical indices as well as by considerations of expense, while picric acid has the further drawbacks of toxicity and risk of explosion.

McFadden (E. S.). **Stem rust is now migrating to the sunny south to spend the winter months.**—*Plant Dis. Reptr*, xxv, 1, pp. 24–25, 1941. [Mimeographed.]

Spore traps exposed at College Station, Texas, on 26th September, 1940, following three days of persistent northerly winds, registered a fall of 36,000 stem rust [*Puccinia graminis*] spores per sq. ft. in the six-hour period between 9 a.m. and 3 p.m., at least 6 per cent. of which were viable. Circumstantial evidence pointed to the origin of the inoculum on volunteer plants in the region north from north-central Oklahoma as far as the Brookings district of South Dakota, and St. Paul, Minnesota. The widespread development of *P. graminis* in the Southern Great Plains during the autumn is hazardous in respect of the 1941 small grain crops, the rust being normally capable of surviving the winter at least as far north as the southern slope of the Edwards Plateau near San Antonio, Texas [*R.A.M.*, xix, p. 463].

Gorter (G. J. M. A.). **Eye-spot lodging disease of Wheat.**—*Fmg S. Afr.*, xvi, 180, pp. 81, 110, 1 fig., 1941.

A popular account is given of eye spot of cereals (*Cercosporella herpotrichoides*), which has been observed of recent years in experimental

wheat plots in the Caledon district of South Africa, where the fungus was previously recorded by L. Verwoerd on the same host in two other localities in 1936 and on oats at Elsenburg in 1933. Investigations on the disease in other grain-producing countries have shown it to be confined to regions with an annual rainfall of 14 to 24 in. Indirect control measures, based on rational methods of cultivation, are briefly indicated, and include shallow, comparatively sparse, and reasonably late sowing (having regard to the desirability of early sowing to avoid rust [*Puccinia* spp.]), rotation with lucerne, soil enrichment with phosphates and nitrogen, and the use of strong-strawed varieties capable of resistance to lodging.

Tapke (V. F.). **A technique for identifying the loose smuts of Barley.**—*Phytopathology*, xxxi, 3, pp. 284–286, 1 fig., 1941.

The following method has been found both rapid and satisfactory for the differentiation of the two loose smuts of barley, *Ustilago nuda* and *U. nigra* [*R.A.M.*, xv, p. 211]. A suspension of spores from loose smut heads is poured over the surface of potato dextrose agar in a Petri dish and allowed to stand until the spores adhere to the agar, whereupon the water is poured off and all excess moisture removed. After 12 to 18 hours at 65° to 70° F. the cultures are usually ready for examination. Under these conditions germination of *U. nuda* is effected only by the production of branching hyphae, while *U. nigra* puts out a short promycelium giving rise later to four sporidia which multiply rapidly by yeast-like budding. The spores of *U. nuda* are usually relatively short-lived, and specimens are held for later identification at 34° to 38° at which temperature the viability of both smuts is appreciably prolonged. The spores of *U. nuda* and *U. nigra* are readily distinguishable from those of *U. hordei* by their echinulate membranes.

Znamenskaya (Mme. M. N.). **Chemical and thermal methods for treating Barley seeds as a control measure against helminthosporiosis.**—*Bull. Pl. Prot. Leningr., 1940*, 1–2, pp. 254–259, 1940. [Russian. Abs. in *Chem. Abstr.*, xxxv, 7, p. 2265, 1941.]

The best experimental control of *Helminthosporium gramineum* on barley was obtained by seed treatment with granosan (1 gm. per kg.) or by ten minutes' immersion in 1 in 400 NIUIF No. 1 [*R.A.M.*, xix, p. 435]. Other successful treatments were 15 to 30 minutes in 0·125 to 0·25 per cent. germisan and 30 minutes in 0·1 per cent. mercuric chloride or 0·2 per cent. mercurized aniline. Disinfection may be carried out a month or two before sowing.

Rademacher (B.). **Über die Veränderungen des Kupfergehaltes, den Verlauf der Kupferaufnahme und den Kupferentzug beim Hafer.** [On the alterations in the copper content, the course of copper assimilation, and the withdrawal of copper in Oats.]—*Bodenk. u. PflErnähr.*, N.F., xix, pp. 80–107, 1940. [Abs. in *Chem. Zbl.*, cxi (ii), 16, p. 2202, 1940.]

The critical period for the supply of copper to oats is in the early stages of growth preceding panicle formation; if this is allowed to pass without the necessary attention, disturbances will result which cannot

be counteracted by subsequent treatments. Although the actual copper requirements of the plant are very modest, the element must be introduced in substantial quantities into 'sick' soil [i.e., soil inducing reclamation disease: *R.A.M.*, xviii, p. 667], since a large proportion becomes fixed and cannot be utilized during the first year after application; in one moorland soil, for instance, only 34·75 gm. of the 25 kg. per ha. given (0·14 per cent.) was recovered from the harvested plants.

MULDER (G.). **Copper deficiency as a cause of 'breaking in new land' disease.**—*Z. PflKrankh.*, l, pp. 230–272, 1940. [German. Abs. in *Chem. Abstr.*, xxxv, 7, p. 2260, 1941.]

Cereals grown in copper-deficient water and sand cultures developed within three weeks symptoms identical with those of reclamation disease [*R.A.M.*, xviii, p. 613]. An addition of 50 $\gamma$ to each 1 l. container sufficed to produce normal plants in the water cultures, whereas considerably larger amounts were required for the soils, in the particles of which the copper became fixed in such a way that only a small proportion was available for the roots [see preceding abstract]. Very susceptible crops (wheat, oats, and barley) needed significantly larger quantities of copper than the comparatively resistant rye and potatoes. The outcome of tests conducted by a modified Neubauer method and a microbiological technique clearly demonstrated a correlation between the amount of available copper in the soils and the development of pathological symptoms. Moreover, the seeds of normal plants contained more copper than those of affected ones. The copper immobilized in 'diseased' soils, partly by certain humus substances as well as through the agency of hydrogen sulphide-producing bacteria, may be made available to the plants by treating the soils with steam, alcohol, or acetone, while manuring with ammonium sulphate in preference to sodium nitrate is also beneficial, likewise an improved tilth.

Although the incorporation of copper sulphate into alkaline, copper-deficient soils is effective against reclamation disease, at the same time it tends to induce the 'grey speck' symptoms of manganese deficiency. Since the immobilization of manganese is due to oxidation by a microorganism catalysed in agar cultures by small quantities of copper, it is probable that the introduction of the latter into field soils is followed by an enhanced microbiological fixation of manganese. Copper-deficient wheat plants have been found to be more susceptible to head diseases than normal ones.

LING (L.). **The histology of infection of susceptible and resistant selfed lines of Rye by the Rye smut fungus, Urocystis occulta.**—*Phytopathology*, xxx, 11, pp. 927–935, 3 figs., 1 diag., 1940.

Studies were carried out at Minnesota to determine the mode of penetration and mycelial development of flag smut (*Urocystis occulta*) in four selfed lines of rye supplied by the University Farm, namely, the very susceptible C–51, the susceptible C–26, and the resistant C–28 and C–37, which were inoculated with chlamydospores of the smut at 15° C. [*R.A.M.*, xix, p. 652].

During the first six days after seed germination no consistent differences could be detected in the reactions of the several lines to invasion

by the fungus, which was effected with equal facility in the resistant and susceptible selections. However, in the resistant lines the ready penetration of the infection hyphae was followed by an almost complete arrest of further mycelial development. Scattered hyphal segments are found in the outer layers of the coleoptile and first leaf, but the mycelium does not spread to the meristematic region of resistant lines, whereas at 28 days of age that of susceptible seedlings becomes permeated from the coleoptilar internode, which is reached a week earlier.

The actual process of penetration of epidermal cell wall of the coleoptile by the binucleate infection hyphae appears to be partly of a mechanical and partly of a chemical nature; it may or may not be accompanied by extensive softening and thickening of the cell wall, and by constriction of the hyphal tips at the site of entry into a host cell.

Attention is drawn to the similarity of *U. occulta*, *Tilletia tritici* [*T. caries*], and *Ustilago avenae* in respect of the uniformity of their behaviour in resistant and susceptible hosts in the initial stages of attack [ibid., x, p. 18; xv, p. 711].

JOHANN (HELEN). **Occurrence of scolecospore-producing strains of Diplodia zeae in the United States.**—*Phytopathology*, xxx, 11, pp. 979–981, 1 fig., 1940.

Since the writer's previous report on the occurrence of scolecospores in a strain of *Diplodia zeae* isolated in 1934 from a decayed maize kernel in Ohio [*R.A.M.*, xviii, p. 307], surveys based on diseased material collected by Hoppe from the 1938 crop denote that such strains are widely distributed in 14 maize-growing states of the American Union. The scolecospores were derived from potato dextrose agar cultures of infected kernels, surface-sterilized with BK, incubated in the laboratory until the surface of the agar became covered with hyphae, when they were transferred to a moist chamber for three to ten weeks. The ivory- to tan-coloured scolecospore masses emerged in the form of droplets or horns and were usually first observed near the distal end of the kernels among the pycnidia discharging the typical brown spores of the fungus, often occurring in profusion on the kernel sides and crown. The pycnidia containing each of the two spore types were very similar, superficial or more or less deeply embedded in the kernel, massed or solitary. The colonies developing from the scolecospores in agar cultures resembled those produced by the ordinary brown pycnospores and in due course gave rise to fructifications of the latter type.

MELCHERS (L. E.) & LOWE (A. E.). **The reaction of Sorghum varieties and hybrids to Milo disease.**—*Plant Dis. Reptr Suppl.* 126, pp. 165–175, 1940. [Mimeographed.]

Tables are given showing the reaction to milo disease (*Pythium*) [*arrhenomanes*: *R.A.M.*, xix, p. 13] of the sorghum varieties and hybrids tested at two Kansas experiment stations from 1930 to 1939. The numbers placed in the susceptible, segregating, and resistant groups as a result of these trials are 66, 13, and 210, respectively. Generally speaking, most of the milos and many of the milo and darso hybrids tend to be susceptible or segregating, while varieties of feterita, sorgo, kafir, Sudan grass, durra, and broom corn [*Sorghum bicolor* var. *technicus*] fall into the resistant class.

Laskaris (T.). **A heritable lysis in germinating chlamydospores of Sphacelotheca sorghi.**—*Phytopathology*, xxxi, 3, pp. 254–263, 2 figs., 1941.

In the course of studies on the genetics of covered kernel smut of sorghum (*Sphacelotheca sorghi*), an abnormality of germination [cf. *R.A.M.*, xii, p. 89] in the form of promycelial lysis before or after the production of sporidia was observed in the monosporidial crosses 22A3×122B3, 22A4×122B2, 122F2, 22A1×22A4, 150, 152, and 154, the incidence of the phenomenon ranging from 20 per cent. in 122F2 and 22A1×22A4 to 90 per cent. in 22A3×122B3. In the last-named cross promycelia may reach 200 $\mu$ in length before disintegrating and frequently no sporidia are formed, though abortive sporidia are not uncommon. One or more genetic factors would appear to be involved in the predisposition to lysis, since it has persisted through two chlamydospore generations and is typical of only certain combinations of lines. The mean lengths and widths of the promycelia produced by the lethal crosses (i.e., those showing considerable lysis) on potato dextrose agar were 20·6 to 71·4 by 2·9 to 4·4 $\mu$ compared with the normal dimensions of 18·2 to 24·4 by 2·8 to 2·9; the abnormal primary sporidia ranged from 9·6 to 18·9 $\mu$ in length as against 9·7 to 10·8 $\mu$ for standard specimens; and finally, the mean chlamydospore diameter of lytic and non-lytic lines ranged from 6·1 to 7·1 and from 6·1 to 6·9 $\mu$, respectively. Experimental evidence failed to disclose any necessary connexion between solopathogenicity (Christensen's term for the capacity of monosporidial lines of *Ustilago zeae* to cause infection and form chlamydospores when inoculated into the host alone [ibid., xi, p. 363]) and the lytic tendency in *S. sorghi*.

Turrell (F. M.) & Klotz (L. J.). **Density of stomata and oil glands and the incidence of water spot in the rind of Washington Navel Orange.** —*Bot. Gaz.*, ci, 4, pp. 862–871, 8 figs., 1 graph, 1940.

The results of experiments carried out at the University of California Citrus Experiment Station at Riverside on water spot of the Navel Orange are given here in greater detail [cf. *R.A.M.*, xix, p. 144], and the conclusion is drawn that neither the density of the stomata nor that of the oil glands in the rind is related to the incidence of this disorder.

Singh (D.). **Withertip of Citrus plants.**—*Punjab Fruit J.*, iv, pp. 722–723, 1940. [Abs. in *Hort. Abstr.*, xi, 4, p. 39, 1941.]

Citrus withertip (*Colletotrichum gloeosporioides*) is stated to be controllable in the Punjab by spraying in February, April, and September with a mixture of 4 lb. each of copper and ferrous sulphates and 8 lb. lime in 50 gals. water.

Klotz (L. J.) & Fawcett (H. S.). **Brown rot and gummosis. Further studies of the fungi causing these diseases in Citrus trees and fruit.**—*Calif. Citrogr.*, xxvi, 5, pp. 114, 142–143, 2 figs., 1941.

The fungi causing citrus brown rot in California (*Phytophthora citrophthora*, *P. parasitica*) [and *P. hibernalis*, and other species: *R.A.M.*, xvii, p. 313; xviii, p. 450] are killed out during summer in the top 2 in. of soil, where the temperature reaches over 110° F. They persist farther

down, however, as vegetative hyphae and resting spores. When the rains set in during autumn, the spores germinate and the hyphae rapidly spread to the surface where the fungi form sporangia liberating zoospores into the rain water, in which they are splashed on to the fruit. Protection is afforded by an application of Bordeaux mixture just before or after the first rain.

In the last six years spraying tests were carried out with 800 different formulae, but no better material than Bordeaux could be found, though the admixture of zinc sulphate is desirable if fumigation is to be carried out before the passage of a rainy season. Protection against brown rot is afforded by a spray consisting of 1 lb. copper sulphate with 1 lb. hydrated lime, as well as by one consisting of 5 lb. zinc sulphate, 1 lb. copper sulphate, and 4 lb. lime.

When the fruits of 90 species, varieties, hybrids, and relatives of citrus were experimentally inoculated with *P. citrophthora* and *P. parasitica* only the small green lime varieties, such as those known as Mexican, Everglade, Key, and West Indian were resistant. In practice it has been found that the disease is most serious on lemons, followed in descending order of susceptibility by Navel oranges, Valencia oranges, and grapefruit.

On a Ramona soil type at Riverside Navel orange trees that were basin-irrigated had 62 times as many infected fruits as furrow-irrigated trees. Ammonium sulphate applied to basin-irrigated trees caused the water to stand on the soil for 24 to 72 hours, though in calcium nitrate-fertilized basins it stood only three hours, and in non-fertilized plots percolated through the soil almost at once. The average number of rotted fruits from the three plots, respectively, was 20·25, 2·25, and 1·5. Trees basin-irrigated every two weeks had 16 times as many infected fruits as those similarly irrigated every four. Basin irrigation, however, causes no appreciable increase of gummosis and brown rot on sandy, open soils. On the Ramona soil 11 out of 13 (84·6 per cent.) Navel orange trees (10 years old) that received 4 in. of water in a basin every two weeks developed gummosis, while only 4 out of 14 (28·6 per cent.) that received this amount every four weeks became affected. No furrow-irrigated trees were attacked.

Evidence was obtained that trees on sweet orange stock can be protected by planting only healthy trees, using only trees that are budded high, setting the young tree so that the first lateral roots are barely covered, and protecting the lower stems with a copper fungicide. In trees that have already become infected the disease is curable by surgical methods. The ideal method of control is, of course, to use immune varieties.

COOPER (H. P.). **Nutritional deficiency symptoms in Cotton.**—*Proc. Soil Sci. Soc. Amer.*, iv, pp. 322–324, 1939. [Abs. in *Chem. Abstr.*, xxxv, 1, p. 254, 1941.]

Potash and sulphur deficiency symptoms are observed in cotton during dry growing seasons, and those of manganese, magnesium, and nitrogen shortage in wet ones, especially if the fertilizers have contained large amounts of nitrates, sulphates, or chlorides. The percentage of red leaves on cotton (a magnesium deficiency symptom) [*R.A.M.*, xix,

p. 135] in a source of nitrogen test ranged from 28·3 per cent. for sodium nitrate to 1 per cent. for a mixture of ammonium sulphate and basic slag. Potash, manganese, iron, and boron deficiency symptoms may develop in plants grown in Coastal Plain soils manured with lime. Rapid growth and high yields may induce deficiency symptoms through the speedy exhaustion of soil nutrients, which remain available, on the other hand, to crops developing slowly and making restricted growth. Disease and root injuries are other factors contributing to deficiency disturbances. The symptoms of nitrogen, potash, phosphorus, and magnesium deficiency in cotton at various stages of growth are described.

JORDAN (H. V.), NELSON (H. A.), & ADAMS (J. E.). **Relation of fertilizers, crop residues and tillage to yields of Cotton and incidence of root rot.**—*Proc. Soil Sci. Amer.*, iv, pp. 325–328, 1939. [Abs. in *Chem. Abstr.*, xxxv, 1, p. 259, 1941.]

The incidence of cotton root rot [*Phymatotrichum omnivorum*] was reduced on Wilson very fine sandy loam by nitrogenous fertilizers and increased by those containing phosphorus, the effects on heavier soils being less pronounced. On Houston soils the disease was combated by turning a second crop of sorghum or early turning of cotton stalks into the soil.

ADAMS (J. E.), WILSON (R. C.), HESSLER (L. E.), & ERGLE (D. R.). **Chemistry and growth of Cotton in relation to soil fertility and root rot.**—*Proc. Soil Sci. Soc. Amer.*, iv, pp. 329–332, 1939. [Abs. in *Chem. Abstr.*, xxxv, 1, p. 259, 1941.]

The nitrogen contents of cotton root bark and leaves was found to be negatively correlated with root rot [*Phymatotrichum omnivorum*], the reverse being the case in respect of phosphorus [see preceding abstract].

PETCH (T.). **The entomogenous fungi of Mauritius.**—*Bull. Mauritius Inst.*, ii, 1, pp. 14–20, 1941.

This is a critically annotated list of over 40 entomogenous fungi of Mauritius, based almost entirely on collections made by R. Mamet since 1934. A Latin diagnosis is given of a new species, *Torrubiella blattae* Petch, collected by J. Vinson on the ootheca of a Blattid, and characterized by gregarious, narrow flask-shaped to conoid, amber perithecia, darkening at the apex, white-tomentose below, glabrous above, 0·5 mm. in height, 0·25 mm. in diameter at the base, and by long-cylindrical asci, 3 $\mu$ in diameter, and linear, multiseptate ascospores, 0·75 $\mu$ in diameter. The specimen of *Beauveria densa* [*R.A.M.*, xviii, p. 676] collected on *Dieuches placidus* differed to such an extent from a subculture of the fungus originally introduced on to the Island for the purpose of combating *Phytalus smithi* that a new species was thought to be possibly involved. The subsequent comparison, however, of a number of cultures and subcultures of *B. densa* supplied by the Canadian Department of Agriculture revealed, not only the loss of pigmentation and pathogenicity already recognized in connexion with the propagation of this organism, but such far-reaching variations in morphological characters as to induce some hesitation in referring them to *Beauveria*. The specimens of *B. densa* collected are probably native examples of this cosmopolitan fungus.

STIFLER (C. B.). **A new genus of Hypocreales.**—*Mycologia*, xxxiii, 1, pp. 82–86, 6 figs., 1941.

A fungus parasitic on termites was collected on dead insects in 1935 below Great Rift Wall, Lake Manyara, Tanganyika, by A. E. Emerson and sent to the author for identification. It is believed to be new to science and is named *Cordycepioideus bisporus*, Latin diagnoses being given for the new genus and species. The genus is characterized by erect, simple or branched, clavate stromata, producing perithecia immersed in the clavate head, the apex of which is sterile. Paraphyses are absent and the evanescent, clavate asci with long stipes each contain two broadly elliptic spores slightly flattened on one side.

FARNESS (O. J.). **Coccidioidal infection in a Dog.**—*J. Amer. vet. med. Ass.*, xcvii, 762, pp. 263–264, 2 figs., 1940.

*Coccidioides immitis* was isolated from the lungs, liver, spleen, and kidneys of a two-year-old female Great Dane at Tucson, Arizona, this being the first record of the fungus in a dog.

SEMON (H. C. G.) & MORITZ (A.). **An atlas of the commoner skin diseases.**—xii+272 pp., 120 col. pl., London, Simpkin Marshall Ltd., 1940. 42*s*.

A number of dermatomycoses are included in this compilation of the better-known skin diseases, illustrated by reproductions by direct colour photography from the living subjects and accompanied by concise observations on the symptoms, diagnosis, etiology, and therapy of the disorders under discussion.

DANGERFIELD (L. F.) & GEAR (J.). **Sporotrichosis among miners on the Witwatersrand gold mines.**—*S. Afr. med. J.*, xv, 7, pp. 128–131, 2 figs., 1941.

Since 1938 68 cases of sporotrichosis (*Sporotrichum? beurmanni*) in native and six in European miners in the Witwatersrand gold mines have been under investigation [*R.A.M.*, vii, p. 240]. The clinical diagnosis was confirmed in all the European cases and in 16 of the natives by cultural examination at the South African Institute for Medical Research; in the other native patients the clinical picture was so characteristic as to leave no doubt regarding the cause. From the history of the cases it is clear that infection was contracted underground.

ELISEI (F. G.). **Nuovo reperto e nuova interpretazione morfologica e sistematica di Malbranchea pulchella Sacc. et Penz, considerata come una nuova specie e un nuovo genere di dermatofiti.** [A new discovery and new morphological and systematic interpretation of *Malbranchea pulchella* Sacc. & Penz., regarded as a new species and a new genus of dermatophytes.]—*Atti Ist. bot. Univ. Pavia*, Ser. IVa, xii, pp. 141–200, 1940. [Abs. in *Zbl. Bakt.*, Abt. 2, ciii, 6–8, pp. 119–120, 1941.]

Latin diagnoses are given of the genus *Malbranchea* Sacc., 1882, emend. Elisei, 1940 [*R.A.M.*, xix, p. 409] (syn. *Thermoidium*), and of its type species *M. pulchella* Sacc. & Penz., 1882, emend. Elisei, 1940 (syn. *T. sulfureum*, *M. bolognesii-chiurcoi*, *M. kambayashii*).

TOMB (J. W.). **The treatment of black hairy tongue (lingua nigra).**—*J. trop. Med.* (*Hyg.*), xliii, 11, p. 155, 1940.

In connexion with a brief note on the therapy of black tongue in an ex-service man who had contracted the disease in India four years earlier, the writer states that this rare condition is due to *Cryptococcus linguae-pilosae* [*R.A.M.*, v, p. 301], and that *Rhizopus niger* and *Nocardia lingualis* [*Actinomyces gueguení*] have also been found associated with it.

YEGIAN (D.) & KURUNG (J. M.). **Dextrose yeast extract medium for the isolation of fungi from sputum.**—*J. Lab. clin. Med.*, xxvi, 7, pp. 1195–1197, 2 figs., 1941.

The following medium has been found definitely superior to Sabouraud's agar ($P_H$ 5·5) for the isolation in an uncontaminated condition of *Coccidioides immitis*, *Monilia* [*Candida*] *albicans*, and other species from the sputum of patients at the New York State Hospital for Incipient Pulmonary Tuberculosis: 8 gm. dextrose, 1·7 gm. sodium chloride, 0·5 gm. yeast extract (Difco), and distilled water to make up to 200 c.c., adjusted to $P_H$ 4. In comparative tests with Sabouraud's agar at $P_H$ 5·5 and 4, bacterial colonies developed in profusion on the former, to a lesser extent on the latter, and were altogether absent on dextrose-yeast extract medium.

DÍAZ (C. J.), MENDOZA (H. C.), LAHOZ (C.), RECATERO (L.), & CANTO (G.). **El alérgeno sensibilizante en el asma de los molineros.** [The sensitizing allergen in millers' asthma.]—*Rev. clín. esp., Madr.*, i, 1, pp. 53–54, 1940. [German and French summaries.]

The writers' observations on 'millers' asthma', stated to be very widespread in Spain, definitely point to the implication of the wheat bunts, *Tilletia tritici* [*T. caries*] and *T. levis* [*T. foetida*], in the causation of the trouble [cf. *R.A.M.*, xix, p. 706]. Positive reactions to spore extracts of the fungi were exhibited by all the patients tested, and passive transmission was effected in two cases. The mass inhalation of these spores in the mill is thought to be quite sufficient to account for the prevalence of the disease, the allergenic properties of the smutted grain being so powerful as to sensitize almost every individual exposed to contact with it.

BRYANT (H. W.) & HAMMER (B. W.). **Bacteriology of cheese. V. Defects of blue (Roquefort-Type) cheese.**—*Res. Bull. Ia agric. Exp. Sta.* 283, pp. 112–147, 10 figs., 1940.

*Hormodendrum olivaceum* [*R.A.M.*, xi, p. 646] was found to be responsible for a black discoloration and musty flavour in blue cheese from a commercial plant in Iowa, ingress being gained through the punch holes and cracks in the surface.

RUDAKOFF (K. I.), HARZSTEIN (N. G.), & SHISHELOVA (MME N. A.). **Catenularia fuliginea als Erreger einiger Defekte bei der gezuckerten Kondensmilch.** [*Catenularia fuliginea* as the agent of some defects in sweetened condensed milk.]—*Microbiology*, ix, pp. 45–52, 1940. [Russian. Abs. in *Chem. Zbl.*, cxi (ii), 15, p. 2103, 1940.]

*Catenularia fuliginea* [regarded by van Luijk as a synonym of *Torula*

*sacchari*: *R.A.M.*, viii, p. 66; xiii, p. 701], was isolated at the Pan Russian Institute for Agricultural Microbiology, Moscow, from some 97 per cent. of condensed milk samples invaded by the chocolate-brown mould, which assumes the form of spots, clumps, 'buttons', and the like, of a brown, reddish, or yellowish colour and imparts to the milk an unpleasant cheesy taste and smell. The optimum temperature for the development of the mould ranges from 20° to 25° C., no growth occurring from $-5°$ to $+5°$ and little at 10° or 30°. *C. fuliginea* thrives in the presence of a saccharose content of 61 to 63 per cent. and is only slightly retarded at 65·5 per cent., whereas at these concentrations *Aspergillus* and *Penicillium* make little progress. The spores of *C. fuliginea* are destroyed by pasteurization. Contamination takes place from the atmosphere in the final phases of manufacture.

COLIN-RUSS (A.). **A contribution to the study and control of mould growth in leather and other materials.**—*J. int. Soc. Leath. Chem.*, xxiv, 12, pp. 395–408, 1 fig., 1 graph, 1940.

Liability to mould growth of a given material, e.g., leather, woven fabrics, or compressed fibres, being of a composite nature, is here resolved into fundamental ratios, methods for the direct determination of which are described. One of these ratios is known as mould weight per unit weight of associated moisture (the available moisture of the material required for mould growth), characteristic mustiness of odour being a frequent concomitant of an upper limit of 20 per cent. associated moisture in the conditioned leather weight. Among the 28 species of fungi recognized by leather technologists prior to 1918, since when the list does not appear to have been appreciably extended, may be mentioned *Mucor mucedo*, *M. racemosus*, *Botrytis cinerea*, *Monilia* [*Sclerotinia*] *fructigena*, *Trichothecium roseum*, *Fusarium putrefaciens* Osterwalder, various *Saccharomyces* and *Torula* spp., *Aspergillus glaucus*, *A. niger*, *Verticillium glaucum*, *Cladosporium herbarum*, *Macrosporium cladosporioides*, *Alternaria tenuis*, and *Mycoderma tannica* Asai. In agreement with Orthmann and Higby in the United States, the author has also found *Aspergillus fumigatus* and *A. versicolor* [*R.A.M.*, ix, p. 316] on leather substrata, besides *Penicillium expansum*. The best of the 19 antiseptics tested against mould growth on leather included merfenil at a strength of only 0·00175 per cent. (May & Baker, Ltd.), alkaline $\beta$-naphthol (0·1 to 0·4 per cent.), and mercuric chloride (0·1, 0·4, or 1 per cent.), of which the first-named is of outstanding efficiency besides being economical.

JONES (L. K.). **Leaf curl and mosaic of Geranium.**—*Bull. Wash. St. agric. Exp. Sta.* 390, 19 pp., 7 figs., 1940.

A tabulated account is given of the writer's studies on geranium (*Pelargonium hortorum*) leaf curl and mosaic in Washington [*R.A.M.*, xvii, p. 684; xviii, p. 442, *et passim*]. Following a description of the symptoms of the diseases the author states that leaf curl is widely prevalent in greenhouses, where the incidence of infection may range from a trace to 45 per cent., the average in one Spokane glasshouse on 18 varieties on 8th May, 1937, 22nd April, 1938, and 23rd April, 1939, being 8, 16, and 6·3 per cent., respectively. The Fiat, Gloede, Michell,

and Viaud were the most severely infected varieties, while Variegated Nutt remained free from the disease, though shown by grafting experiments to be susceptible. Mosaic is also widespread, especially in the Seattle and Tacoma districts, but is less injurious than leaf curl; the Michell variety sustained the heaviest damage (up to 40 per cent.) among the seven under observation in 1938. Both viruses are readily transmissible by grafting from diseased to healthy plants, but not by mechanical inoculation to geranium, tobacco, or tomato, by the knife used in making cuttings, or through the seed. A low incidence of natural dissemination of both viruses was observed in the field, but no evidence has been secured of the implication of insects in this process. The development of leaf-curl symptoms was not influenced by temperature variations between 50° and 70° F., protracted daylight, or reductions in the available potash, nitrogen, or phosphorus supplies, but in 1938 plants watered with manure solution showed a marked improvement after a fortnight, which was still maintained a month after the treatment, a similar but less pronounced effect being exerted by Vigoro (1 lb. per 10 sq. ft.) and iron sulphate solution (1 in 100). The careful selection of symptomless plants, grown in the field during the summer for autumn propagation, resulted in a substantial reduction in the amount of leaf curl over a three-year period, while practically complete control of both diseases was obtained by the drastic roguing of affected plants from a bed of stock in the greenhouse.

PIESTER (E. A.). **Relative susceptibility of Rose varieties to black spot.**—*Plant Dis. Reptr*, xxiv, 23, pp. 478–480, 1940. [Mimeographed.]

Lists are given showing the degree of susceptibility of different rose varieties to *Diplocarpon rosae* [*R.A.M.*, xvii, p. 821]. The most resistant (foliage clean or nearly so) are Donald Prior, Henry Nevard, Lady Ursula, Miss America, Mrs. Charles Bell, Mrs. Wakefield Christie-Miller, Pink Dawn, and Susan Louise. The foliage of the last-named remains completely unaffected.

TOMPKINS (C. M.) & HANSEN (H. N.). **Tulip-anthracnose.**—*J. agric. Res.*, lxii, 1, 3 figs., 1941.

This is a full account of the anthracnose of tulips in California caused by *Gloeosporium thumenii* f. *tulipae* n.f. [without a Latin diagnosis: *R.A.M.*, xx, p. 21], which is stated to produce conidia varying in size from 9·75 to 23·75 by 3·25 to 7·25 $\mu$, but mostly about 15 by 5 $\mu$, in well-defined acervuli from 0·2 to 1·5 mm. in diameter.

LINN (M. B.). **Cephalosporium leaf spot of two Aroids.**— *Phytopathology*, xxx, 11, pp. 968–972, 2 figs., 1940.

A technical description [in English only] is given of *Cephalosporium cinnamomeum* n.sp., the agent of circular to irregular, reddish-brown, yellow-bordered, necrotic lesions, up to 5 or 6 mm. in diameter, on the leaves of *Nephthytis afzelii* and *Syngonium podophyllum* var. *albolineatum* in a greenhouse on Staten Island, New York, and of occasional reddish-brown, elongated spots, 1 to 3 mm. in length, on the petioles. The fungus, which forms cinnamon-buff colonies on 2 per cent. potato dextrose-agar, is characterized by terminal and intercalary chlamydospores, 12

to 14 by 7 to 10 $\mu$, erect or decumbent, simple and continuous or compound and septate conidiophores, 3·5 to 45 by 1·6 to 2·8 $\mu$, producing in mucous heads, 8 to 18 $\mu$ in diameter, ovoid to short-cylindrical, non- or uniseptate conidia, 4·2 to 15 by 1·5 to 5·8 $\mu$ (from the erect conidiophores), as well as cylindrical, uni- to quadriseptate, up to 22·6 $\mu$ (from the decumbent). The minimum, optimum, and maximum temperatures for the development of the pathogen in culture were found to be 9°, 24° to 27°, and 30° C. Positive results were obtained in inoculation experiments on both the above-mentioned Araceae with portions of agar cultures or spore suspensions of *C. cinnamomeum.*

Brown (B. A.) & King (A.). **Soil conditions under which Alfalfa responded to boron.**—*Proc. Amer. Soil Sci. Soc.*, xxxv, 1, pp. 310–313, 1939. [Abs. in *Chem. Abstr.*, xxxv, 1, pp. 259–260, 1941.]

Boron deficiency symptoms were observed in lucerne in Connecticut for the first time in 1939 [*R.A.M.*, xix, p. 543; xx, p. 192]. The application of 20 lb. borax per acre reduced the incidence of yellows from 25 to 3 per cent., increased plant height and yields by 15 and 16 per cent., respectively, and raised the boron content of the foliage from 21 to 62 p.p.m. No further advantage was derived from the addition of manganese, calcium, or zinc to potash-borax or potash-superphosphate-borax treatments.

Smith (O. F.). **Stemphylium leaf spot of Red Clover and Alfalfa.**—*J. agric. Res.*, lxi, 12, pp. 831–846, 4 figs., 1940.

A fungus, identified as *Stemphylium botryosum* [*R.A.M.*, xviii, p. 141] with the perfect stage *Pleospora herbarum* [loc. cit.], is described as causing a disease of red clover (*Trifolium pratense*) and lucerne in Wisconsin. The disease attacks mainly the leaves, producing irregular, dark brown to black lesions often surrounded by a straw-coloured halo, but it may occasionally produce small, black, linear lesions on stems and petioles. The lesions on the leaves increase rapidly and coalesce, and the petioles sometimes break at the locus of infection. The fungus usually enters the leaf tissues through the stomata but may also penetrate directly between the epidermal cells, growing intercellularly and killing the host cells on its way. Conidiophores and conidia, which rarely develop in culture, are produced in abundance on leaf lesions in about five to eight days after inoculation. The pathogenicity of the fungus to both red clover and lucerne was proved by greenhouse inoculations, and the organism was reisolated from the lesions produced. Cultures of the fungus from red clover inoculated into a limited number of leguminous hosts produced slight infection on *Medicago arabica*, lucerne, *T. resupinatum*, and *Melilotus alba*, which last was also found to carry the fungus on or in the seeds. There appeared to be two physiologic races of *P. herbarum.* When a conidial suspension from diseased lucerne was inoculated into red clover and lucerne plants, leaves of lucerne were completely killed in about five to eight days whereas only slight infection appeared on red clover after 16 days; when, on the other hand, the two hosts were inoculated with a conidial suspension from red clover, leaves of red clover were killed after about five to seven days and only small lesions were produced on lucerne after 14 days. This physio-

logic specialization was further confirmed by results of inoculations with ascospores and perithecial fragments and by field observations.

*P. denotata* is thought to be synonymous with *P. herbarum*, the latter name being preferred in spite of the fact that the ascospores from red clover are a little longer than the measurements given by Saccardo for that species. The fungus on lucerne described by Tehon and Daniels [ibid., v, p. 232] as *Thyrospora sarcinaeforme* is identified, on the basis of materials supplied by L. R. Tehon, as *S. botryosum*. No specimen could be obtained of *Macrosporium medicaginis* Cugini either from Cugini or any Italian stations, but from the description of this organism given by Traverso it seems to be distinct from *S. botryosum* as well as from all the other fungi described on lucerne. Diseased seeds of red clover and lucerne received from Wageningen on the suggestion of Gentner yielded ascospore cultures apparently identical with those described by Gentner as *P. herbarum* with *M. sarciniforme* [ibid., xviii, p. 716] as a conidial stage; conidia obtained on leaf lesions were, however, very similar to those of *S. botryosum* and the conidial stage is therefore considered to be this species. An examination of a small portion of the material collected by Peck and named *M. meliloti* showed it to be quite distinct from the fungus under consideration and its spores to be very similar to those of *M. commune* [ibid., xviii, p. 757] from asparagus, the two fungi probably belonging to the same species of *Alternaria*. *P. lycopersici*, described by Ramsey [ibid., xiv, p. 799], is stated to be very similar in both the conidial and the perithecial stages to *P. herbarum*, but inoculations of both red clover and lucerne with a culture of *P. lycopersici* obtained from Ramsey gave no infection on lucerne and only a slight one on red clover, and it was less virulent than *P. herbarum* isolated from that host.

JOHNSON (H. W.), RODENHISER (H. A.), & LEFEBVRE (C. L.). **Two types of fall Panicum smut.**—*J. agric. Res.*, lxi, 12, pp. 865–875, 6 figs., 1 graph, 1940.

The results of inoculation experiments with *Sorosporium syntherismae* on *Panicum dichotomiflorum*, conducted at the Arlington Experiment Farm, Virginia, in 1938, showed that after the inoculated seed had been incubated for 26 days at 5°, 10°, 15°, and 20° C. the percentages of plants developing smut were 70·9, 72·5, 53·3, and 22·2, respectively. In the course of these experiments one smutted plant was observed to have buff sori containing hyaline, smooth-walled, and almost spherical chlamydospores, while all the remaining 307 plants had the common black sori with brown, echinulate or minutely verrucose, and subspherical or somewhat polyhedral spores. There was very little difference in spore size of the two types. Single chlamydospore cultures of the buff smut were mycelial and quite stable, while those of the black smut were of the sporidial type with a pronounced tendency to sector. Both types grew slowly at 5°, had an optimum near 20°, and a maximum between 30° and 35°. In inoculation experiments in 1939 with both types of smut, the 68 smutted plants which resulted from inoculation of seed with chlamydospores of the buff smut all produced only buff sori, while the 240 smutted plants that resulted from inoculation of seed with chlamydospores of the black smut all produced only black sori.

It is concluded that the buff smut is a result of mutation in *S. synther-ismae* and that the change may involve several genetic factors.

Anet (H.). **L'action du bore sur les végétaux et son rôle dans les maladies physiologiques ou de carence des arbres fruitiers.** [The effect of boron on plants and its significance in the physiological or deficiency diseases of fruit trees.]—*Rev. hort. vitic. Suisse rom.*, xiii, pp. 214–221, 1940. [Abs. in *Hort. Abstr.*, xi, 4, p. 17, 1941.]

A number of excellent photographs are stated to accompany a description of the effect of boron deficiency on fruit trees in Switzerland, amplified by an account of the author's own experiences in the rejuvenation of apparently dying apples and pears by the application of borax to the soil. Apple varieties subject to 'coulure' (premature shrivelling of the flowers) and fruit malformation were cured of this condition (of ten years' duration) by the incorporation of borax with the soil at the rate of 4 gm. per sq. m.

Meier (K.). **Düngeversuche mit Obstbäumen. 6. Mitteilung. Ueber Kalimangelerscheinungen und die Wirkung der Kalidüngung auf kalibedürftigem Boden.** [Manuring experiments with fruit trees. Note 6. On potash-deficiency symptoms and the effect of potash manuring on potash-deficient soil.]—*Annu. agric. Suisse*, liv, 9, pp. 944–974, 1 col. pl., 6 figs., 5 graphs, 1940. [French summary.]

A detailed, fully tabulated account is given of experiments and analytical researches at the Wädenswil Federal Fruit-Growing Station to determine the relation between the established insufficiency of potash in the local soil and certain pathological manifestations in fruit-trees, notably apples (Cox's Orange Pippin) and apricots, including leaf scorch [*R.A.M.*, xiii, p. 40; xvii, p. 254], inadequate wood development, reduced blossom set and yields, and ultimate decline. The cause of the trouble appears to reside not only in a shortage of potash, phosphoric acid, and nitrogen, but also of boron [see preceding abstract]. Soil analyses have shown that a minimum of 4 to 5 mg. readily soluble potash per 100 gm. soil must be available in order to avoid injury to the trees. Xylem analyses were found to constitute a valuable adjunct to the studies, revealing an antagonism already observed by some English and German workers on the same lines, between potash on the one hand and lime, iron, magnesia (not convincingly demonstrated in these experiments), and phosphoric acid on the other. The condition under discussion being widespread in the Wädenswil district on currants [ibid., xiii, p. 173], gooseberries, and other plants, as well as on fruit-trees, attention is hereby drawn to the advisability of timely prophylactic measures. Potash may be economically applied in the form of wood ash in amounts to be determined by analyses of the special requirements of a given soil.

Baines (R. C.). **Observations on the maturation of the ascospores of the Apple scab fungus in Indiana.**—*Hoosier Hort.*, xxiii, 3, pp. 40–41, 1941.

From 1934 to 1940 the development of the ascospores of apple scab [*Venturia inaequalis*] was followed at 18 locations in Indiana, and each

spring maturity was found to have been reached by the time the buds were in the delayed-dormant stage [*R.A.M.*, xx, p. 104], sometimes two to three weeks earlier. The ascospores did not all ripen simultaneously, the entire process of maturation and expulsion occupying a period of two to three months. In most years a very high percentage of the fructifications was discharged before the application of the first cover spray. Growers are advised to give a treatment of 2 in 100 lime-sulphur at the pre-pink stage, followed by sulphur sprays at six- to seven-day intervals until the first cover.

ANDERSON (H. W.). **Apple tree anthracnose in Illinois.**—*Plant Dis. Reptr*, xxiv, 23, p. 475, 1940. [Mimeographed.]

Apples from Jo Daviess county, Illinois, left in a container for some days, showed the presence of *Neofabraea malicorticis* [*R.A.M.*, xix, p. 226]. The fact that the disease has also been reported from Maine indicates that it may be more widely distributed in the northern apple-growing region of the United States than has been supposed. The trees in the Illinois orchard had all been obtained from a Missouri nursery, and not from the north-west.

EIDE (C. J.) & CHRISTENSEN (C. M.). **Wood decay in Apple trees in Minnesota.**—*Phytopathology*, xxx, 11, pp. 936–944, 2 figs., 1940.

Ten species of wood-rotting fungi were isolated on malt or potato dextrose agar from the decayed regions of felled apple trees in Minnesota between 1936 and 1938, 48 out of 50 15-year-old trees being partially rotted 3 ft. above soil-level, 12 out of the 68 22-year-old trees showing extensive involvement of the trunk, while moderate to slight infection was found in 44 out of the remaining 56 up to 30 years of age. The fungi were *Fomes applanatus* [*Ganoderma applanatum*], *Trametes malicola*, *Polyporus* [*Polystictus*] *versicolor*, *Thelephora* sp., *Polyporus resinosus*, *Pholiota adiposa*, *Schizophyllum commune* [*R.A.M.*, xvii, p. 688], *Trametes hispida*, *Polyporus adustus*, and *Lenzites betulina*. The number of wood-rotting fungi isolated but not identified equalled or exceeded those enumerated. Branch stubs were the chief means of entry, others being crotch cracks, sun scald and frost injuries. No one species or combination of species was observed with sufficient frequency to be deemed responsible for the major part of the decay, which is thought to be one of the factors in the early decline of apple trees in the State, and might be obviated to some extent by the prevention or proper care of wounds. The sporophores of *S. commune* occurred in profusion on bark killed by sun scald, the fungus being probably a secondary invader. Most of the rots were white, but those associated with *Pholiota adiposa* and *T. malicola* were of the brown, cubical type.

KLEE (H.). **Schädigungen durch Taphrina deformans (Berk.) Tul. an Pfirsichfrüchten.** [Injuries to Peach fruits by *Taphrina deformans* (Berk.) Tul.]—*NachrBl. dtsch. PflSchDienst.* xx, pp. 13–14, 1940. [Abs. in *Zbl. Bakt.*, Abt. 2, ciii, 6–8, p. 125, 1941.]

Peach fruits (especially of the Proskau variety) as well as leaves [? in Germany] were observed to show the slight superficial puffiness and wrinkling due to *Taphrina deformans*, early attacks by which

sometimes also caused shrivelling, malformation, and shedding. Asci were not detected, but the identity of the pathogen is not considered to be in doubt.

DUNEGAN (J. C.). **Physalospora obtusa on Peach nursery stock in Arkansas.**—*Plant Dis. Reptr*, xxv, 1, pp. 25–26, 1941. [Mimeographed.]

*Physalospora obtusa* was isolated on maize meal agar from the dark brown or black, sunken tissues of basal cankers on the main stems of young peach trees in a commercial nursery in Arkansas. The affected trees (only 1 per 1,000) occurred as isolated cases scattered through the nursery. The cortical tissues of the invaded areas were brown and collapsed, and contained longitudinal gum pockets. In the older portions of the cankers the xylem, as well as the outer zones, was involved in the discoloration, only the pith cylinder retaining its normal aspect. The pathogen is believed to have entered the stems through mechanical injuries.

ROBERTS (J. W.). **The constriction disease of Peach.**—*Phytopathology*, xxx, 11, pp. 963–968, 1 fig., 1940.

The constriction disease of peach described by Selby (*Bull. Ohio agric. exp. Sta.* 92, pp. 233–234, 1898) was observed in Delaware in 1938 causing severe damage to weakened or injured trees. The infected areas are pale tan to brown and are usually centred round a dead bud. The girdling results in the wilting and death of the branch above. The agent of the trouble, originally referred to *Phoma persicae* [*R.A.M.*, xvii, 472], is believed on the basis of further investigations to be identical with *Phomopsis mali*. The $\alpha$ conidia isolated from two affected peach trees in Delaware measured 8 to 9 by 3 to 4 and 6 to 8 by 3 $\mu$, respectively, and the $\beta$ forms 28 to 36 by 1 to 2 and 26 to 33 by 1 to 2 $\mu$. These dimensions agreed fairly closely with those of isolates from peach in New Jersey (no $\beta$ conidia), and cherry, apple, and pear in Maryland. All the isolates, except one from Delaware peaches, were inoculated into wounded peach and apple branches with positive results. The disease would appear to correspond with the die-back attributed in Great Britain to *Diaporthe perniciosa* [ibid., xvii, p. 466] or *D. eres* according to Wehmeyer's classification [ibid., xiii, p. 270], with which the Delaware pathogen is presumably identical, although the perfect stage has not yet been observed either in nature or in culture.

HILDEBRAND (E. M.) & PALMITER (D. H.). **Status of yellow-red virosis in 1940.**—*Plant Dis. Reptr*, xxiv, 23, pp. 470–473, 1 map, 1940. [Mimeographed.]

Since the authors' last note on the distribution of the 'X' disease or yellow-red virosis of peaches in New York State [*R.A.M.*, xviii, p. 401; xix, pp. 292, 548] the disease has spread to peach orchards in another Hudson Valley county and three counties of western New York. So far, it has been found on peach in 7, and on chokecherry [*Prunus virginiana*] in 43, counties. The disease is gradually moving southwards and northwards, and is now much more abundant than before in areas already invaded. Peach orchards first found affected in 1939 showed 20 to 100

per cent. increase in infected trees in 1940. Trees presenting the disease for the second year bore practically no fruit. Orchards affected for three years and in which no attempt has been made to check the disease are virtually 100 per cent. affected and are being removed.

Diseased chokecherries have been found in or near many orchards at present unaffected, and it is considered to be only a matter of time for these orchards to become attacked unless diseased chokecherries in the vicinity are removed to a distance of at least 500 ft. Thorough spraying of chokecherries in July with sodium chlorate ($\frac{3}{4}$ lb. per gal. water) gave a high degree of kill. Similar applications in September were much less satisfactory.

Richards (B. L.). **Virus disease of Peaches spreading in Utah.**—*Plant Dis. Reptr*, xxiv, 23, p. 474, 1940. [Mimeographed.]

'X' disease of peach [see preceding abstract] was first observed in Utah on chokecherry [*Prunus virginiana*] in 1937 and on peach in Box Elder County in July, 1939. Preliminary surveys in August, 1939, showed the disease to be generally distributed in high percentages throughout Box Elder, Weber, and Davis Counties. In 1940, it was found in Salt Lake and Cache Counties. Utah County and the southern peach areas of the State appear, as yet, to be unaffected. Of 20 orchards visited in Davis County in 1939, only two over four years old were unaffected. The average incidence of infection for the 20 orchards was 23 per cent. of the trees. In five of the orchards over 40 per cent. of the trees were diseased, and in one of these (six years old) the figure was 68 per cent., and the disease was so severe that all the trees were pulled out and destroyed. In 1940, incidence reached 75 per cent. in some orchards. Definite evidence was obtained that the disease is transmissible.

Blodgett (E. C.). **Rusty spot of Peach.**—*Plant Dis. Reptr*, xxv, 1, pp. 27–28, 1941. [Mimeographed.]

Attention is drawn to the detection in Idaho during the summer of 1940 of an apparently undescribed peach disease, herein provisionally designated 'rusty spot' and characterized by the presence on the young fruits of small, rust-coloured spots, looking as if drops of rusty water had settled into the superficial hairs, which are rubbed off, leaving a bald and finally purplish, smooth, shiny patch. With the approaching maturity of the fruits, the diseased areas, which may cover half or the whole surface, often developed a well-marked red, pink, or bluish-purple margin. Severe dwarfing and malformation of the fruits was a feature of the disorder in extreme cases, the flesh further being hardened and insipid. The leaves and twigs of the trees were normal. Usually when any fruit on a tree was affected the whole tree was diseased, while adjacent trees may show no symptoms. Further investigations are in progress.

Staehelin (M.). **Une dangereuse maladie des sarments du Framboisier** [A dangerous disease of Raspberry spurs.]—Reprinted from *Rev. hort. vitic. Suisse rom., 1940*, 5, 3 pp., 2 figs., 1940.

A semi-popular description is given of the life-history and symptoms

of raspberry spur blight (*Didymella applanata*), the rapid extension of which in Swiss plantings [*R.A.M.*, xvii, p. 375] gives serious cause for alarm. The following schedule of preventive treatments is recommended on the basis of experiments at the Lausanne Viticultural and Arboricultural Station from 1935 to 1938 on the Preussen, Winkler Seedling, and Lloyd George varieties (the last-named used in 1938 only): cutting off and burning of dry or wilting shoots in the spring; two to three applications of Bordeaux mixture (1 per cent. used in the experiments) or copper oxychloride (cuprenox) [ibid., xvi, p. 773] with the addition of an adhesive from mid-May to the onset of flowering; after the harvest, during August and September, treatment with copper dusts (sulfostite); and between November and February 2 per cent. Bordeaux mixture.

ZUNDEL (G. L.). **A new Black Rasberry disease in western Pennsylvania.** —*Plant Dis. Reptr*, xxv, 3, pp. 87–91, 1941. [Mimeographed.]

Black raspberries [*Rubus occidentalis*] in western Pennsylvania have recently become affected by a very serious trouble for which the name 'brown berry disease' is proposed pending further knowledge of its etiology, now under investigation. The berries turn brown and harden to such a degree that they adhere firmly to the receptacle, causing difficulty in the separation of the drupelets. Every berry in a given cluster may be attacked, the Cumberland variety sustaining heavier damage than Plum Farmer. The tabulated results of counts of 100 fruit clusters (864 berries) in Lawrence County revealed an incidence of 81·2 per cent. infection, the corresponding figure for a similar count in Butler County on 984 berries being 61·8. These conservative estimates represent heavy losses to the growers concerned, and a remedy is urgently necessary to save the industry from extinction. A disorder of the same type as the foregoing is also reported from Ohio.

PLAKIDAS (A. G.). **Purple leaf spot of Strawberry.**—*Phytopathology*, xxxi, 3, pp. 225–240, 4 figs., 1941.

English and Latin diagnoses are given of *Mycosphaerella louisianae* n.sp., the agent of a hitherto undescribed strawberry disease in Louisiana, North Carolina, and Mississippi, the symptoms of which agree well with those reported by Wolf for leaf scorch (*Diplocarpon earliana*) [*R.A.M.*, v, p. 616] except for the absence in the former of 'dark, glistening acervuli' on the surface of the spots. The reddish-purple, later brownish, spots, 1 to 5 mm. in diameter, tend to coalesce and form large irregular, purple areas on the leaves.

The fungus is characterized by groups of erumpent, amphigenous, black, globose, ostiolate perithecia, 34 to 75 by 34 to 75 (average 56·9 by 59·8) $\mu$, and cylindrical to clavate asci, borne on short stalks, fasciculate, the marginal ones curved, the central straight, aparaphysate, 27·3 to 39 by 5·9 to 7·3 (32·7 by 6·4) $\mu$, each containing eight imperfectly biseriate, hyaline, bicellular, obtuse ascospores, 6·8 to 10·2 by 2·4 to 3·4 (8·9 by 3·1) $\mu$. No conidial stage was observed either in nature or in culture, but since the perithecia develop at all times of the year soon after the death of infected leaves, no other types of fructification are necessary to ensure the perpetuation of the fungus, which throve on a number of standard media at 25° C. The pathogenicity of

the organism was demonstrated by inoculation experiments on 72 Klondike plants, ingress being effected through stromata on the lower leaf surface only.

*M. louisianae* differs from *M. fragariae* in its smaller perithecia, asci, and ascospores and in its predominantly hypophyllous instead of epiphyllous position of the perithecia. The purplish lesions produced by *M. louisianae* never develop the greyish-white centres characteristic of those due to *M. fragariae*. It also differed in not producing conidia in culture. Conclusive proof of the genetic connexion between *M. fragariae* and *Ramularia tulasnei* has hitherto been lacking, but was obtained by sowing on agar disks single and multiple ascospores, derived from perithecia on overwintered wild strawberry (*Fragaria virginiana*) leaves in Michigan, which gave rise to an abundance of conidia morphologically indistinguishable from Louisiana specimens of *R. tulasnei*. However, judging by the scarcity of mature perithecia and the profusion of sclerotia on overwintered foliage from widely separated areas, the ascigerous stage of *R. tulasnei* is of little importance in the perpetuation of the fungus, even in northern latitudes.

Das Gupta (S. N.), Verma (G. S.), & Sinha (S.). **Studies in the diseases of Mangifera indica Linn. Part III. Investigation into the effect of sulphur dioxide gas on the Mango fruit.**—*Proc. Ind. Acad. Sci.*, Sect. B, xiii, 1, pp. 71–83, 2 pl., 1941.

Experiments in which mangoes still attached to the trees were exposed inside specially designed chambers to known concentrations of sulphur dioxide gas [*R.A.M.*, xix, p. 663] for periods ranging from 30 minutes to eight days showed that such exposure produced brick-red spots on the skin. The spots enlarged after the fumigation, and in some cases coalesced, but this condition in no way resembled black tip disease [loc. cit.]. In the affected region the epidermal cells lost chlorophyll, starch was reduced, the cell walls turned brown, and light brown deposits occurred in the cell cavities, the effect on the tissue being greatest just below the lenticel. Suberization occurred round the affected area. The deposits found in the epidermal and mesocarp cells were comparable with those seen in the first etiolation stages of black tip disease, but no conclusions can yet be drawn from this observation.

Yamamoto (W.). **A brownish sooty mould, Phaeosaccardulina javanica (Zimm.) comb. nov., on Persimmon.**—*Ann. phytopath. Soc. Japan*, x, pp. 254–264, 1940. [Japanese, with English summary.]

A description is given of a very prevalent brownish sooty mould occurring in association with the scale insect *Tachardina theae* on persimmon leaves in Formosa, and with other insects on a wide range of hosts, namely, *Phaeosaccardulina javanica* (Zimm.) n. comb., six of the 15 synonyms of which are listed as *Capnodium javanicum* Zimm., *P. theae*, *P. samoensis*, *Chaetothyrium javanicum*, *Limacinia javanica*, and *Limacinula javanica* [*R.A.M.*, x, p. 558].

Grubitsch (H.). **Copper-bearing sprays.**—*Öst. ChemZtg*, xliii, pp. 214–220, 1940. [German. Abs. in *Chem. Abstr.*, xxxv, 7, p. 2267, 1941.]

Studies were conducted on the effect of the copper sulphate pentahy-

drate: sodium carbonate ratio in copper-soda sprays, of the copper sulphate pentahydrate: calcium hydroxide ratio in those of copper-lime, and of the temperature of preparation and other factors on the proportion of dissolved and ionized copper and on the hydrogen-ion concentration of the mixture. Determinations were made of the copper: carbon dioxide ratio in sediments from copper-soda sprays and of the effect of mixing ratios in both types of sprays on the velocity of sedimentation. It is concluded that the toxic action of copper-containing mixtures on plant tissues [*R.A.M.*, xv, p. 36 *et passim*] is due to the presence of ionic copper. In the phenolphthalein-reddening copper-lime sprays employed in practice the amount of copper in the solution ranges from 10 to 150 mg. per l. and the ionized copper from $10^{-3}$to $10^{-10}$ mg. per l. In copper-soda sprays the heaviest burning of vines occurs when the ratio of copper sulphate pentahydrate to sodium carbonate ranges from 1 : 1·00 to 1 : 1·200. The dissolved copper varies between 85 and 100 mg. per l., and the ionized copper from 30 to 40. Carbon dioxide escapes from copper-soda mixtures in the process of spraying, resulting in a sharp decrease in dissolved and ionized copper. Assuming that a non-toxic copper concentration is first attained during the course of spraying, poor atomization would entail scorching of vine foliage. The toxicity of copper-lime sprays increases parallel with the neutralization of the spray sediment by atmospheric and respiratory carbon dioxide, but copper-soda mixtures lose part of their toxicity in spraying and more on the drying-out of the deposit and washing-out of soluble salts by rain and dew. The effect of weather conditions at the time of spraying is discussed, and a bibliography of 22 references appended.

Naoumoff (N. A). Болезни сельскохозяйственных растений (фитопатология). [Diseases of economic crops (phytopathology)].—566 pp., 134 figs., Госуд. Издат. колх.-совх. Литер. „Сельхозгиз". [State Publ. Off. Lit. collect. co-op. Farming 'Selkhozgiz'], Leningrad, 1940. Roub. 12. Kop. 35.

This is a general text-book on non-parasitic, bacterial, fungous, and virus diseases of economic plants, divided into six chapters dealing fairly fully with general information on plant diseases, methods of controlling plant diseases, diseases of field crops, diseases of vegetable and similar crops, and diseases of fruit and berry crops, respectively. Certain important diseases other than those occurring in U.S.S.R. are discussed in the text, which aims at providing a general introduction to the subject of plant pathology for students in agricultural colleges. A bibliography of 26 pages of mainly Russian literature is appended.

Puttemans (A.). **Some data concerning the history of phytopathology in Brazil and the first notices of diseases of plants in the country.**—*J. Agric. P. R.*, xxiv, 3, pp. 77–107, 9 pl., 1940.

This is an English translation by Anna E. Jenkins and Annie D'Armond Marchant of an address on the history of phytopathological research in Brazil delivered by the author (since deceased) in Portuguese at the General Session, 22–23 January, 1936, of the First Meeting of the Phytopathologists of Brazil. The original text was published in *Rodri-*

*guesia* 2 (numero especial), pp. 17–36, 1936 (1937). [The translation is preceded by a foreword by Miss Jenkins, and a digest of Puttemans's paper by the same author appears in *Chron. bot.*, vi, 10, pp. 224–226, 1941.]

DADE (H. A.). **A revised list of Gold Coast fungi and plant diseases.**—*Kew Bull., 1940*, 6, pp. 205–247, 1940.

This list is in part a revision of that published in 1924 [*R.A.M.*, iv, p. 495], and includes numerous new records made since then. A preface briefly indicates the history of plant pathological research in the Gold Coast and the nature of the records. Part I is a list of fungi and viruses arranged alphabetically in broad systematic groups; part II is a host index.

STEVENS (N. E.). **Recent trends in plant disease control.**—*Trans. Ill. Acad. Sci.*, xxxiii, 2, pp. 66–67, 1 graph, 1940.

With a view to discovering whether there were any significant changes in emphasis on the type of disease control studied and recommended by plant pathologists throughout the world of recent years, the writer analysed the references to this subject appearing in the *Review of Applied Mycology* during the period from 1922 to 1938, inclusive. Following a slight increase in the already large number of such references (some 550 per annum) at the opening of the period, there was a sharp drop beginning about 1926 and culminating in 1931, succeeded by a second increase and a smaller drop in 1935–6. Allowing for the possible errors involved in the nature of the method of computation [cf. *R.A.M.*, xx, p. 269], it appears probable that the first large decline reflects a natural loss of interest in plant disease control associated with a marked surplus of agricultural products in most of the countries actively engaged in phytopathological research, while the upward trend soon after 1930 coincides with a degree of financial recovery and some regulation of the volume of agricultural production.

Throughout the period under review, spraying and dusting make up approximately one-third of the total number of proposed control measures. Next in importance comes seed treatment, which shows some decline in popularity from its peak of nearly 20 per cent. in 1926 to 13 per cent. in 1933, followed by an increase due in all probability to the development of new and very effective chemical compounds. Breeding for resistance has been rather more widely advocated during the last ten years than at the opening of the period under discussion, but still accounts for only 10 per cent. of all suggestions for control. Interest in local sanitation, including eradication, has diminished from between 12 and 13 to 6 to 7 per cent., while a similar falling-off is noticeable in the cases of seed certification and heat treatments. On the other hand, from 1928–9 onwards there has been a steady increase in the number of recommendations for the control of soil deficiency diseases by the application of minute amounts of essential chemical elements, especially boron, reaching 10 per cent. of the whole in 1935.

COTTAM (C.). **The Eelgrass situation, fall 1940.**—*Plant Dis. Reptr*, xxv, 2, pp. 46–52, 1941. [Mimeographed.]

Although the situation as regards the condition and abundance of

eelgrass (*Zostera marina*) in the areas of Canada and the United States affected by wasting disease (*Labyrinthula*) [? *macrocystis*: *R.A.M.*, xix, p. 421] was not altogether uniform in the autumn of 1940, taking the Atlantic coast as a whole, the improvement is more marked than at any time since the onset of the trouble in 1931, especially in regions of reduced salinity.

FELDMANN (J.). **Une nouvelle éspèce de Plasmodiophora (P. bicaudata) parasite du Zostera nana Roth.** [A new species of *Plasmodiophora* (*P. bicaudata*) parasitic on *Zostera nana* Roth.]—*Bull. Soc. Hist. nat. Afr. N.*, xxxi, 7–9, pp. 171–177, 2 figs., 1940.

A technical description [accompanied by a Latin diagnosis] is given of *Plasmodiophora bicaudata* n.sp., isolated from specimens of *Zostera nana* (a species unaffected by the dying-off disease attributed to *Labyrinthula* [? *macrocystis*: see preceding abstract] or other agencies) in Mauretania (French West Africa) in 1938, and regarded as the agent of a thickening of the stems, curtailment of the internodes, and cellular hypertrophy of the host. The organism is characterized by plurinucleate plasmodia, the nuclei numbering 20 to 50 and measuring 3 to 4 $\mu$ in length, single, yellow (fuscous in the mass), ovoid spores, 7 by 3 to 3·5 $\mu$, tapering to a point at either end and each one entirely filling a host cell. The myxamoeboid stage was not observed.

**Techniques for appraising air-borne populations of micro-organisms, pollen, and insects.**—*Phytopathology*, xxxi, 3, pp. 201–225, 5 diags., 1941.

The Committee on Apparatus in Aerobiology, National Research Council, Washington, D.C., here presents a survey of the literature on the mechanism of appraisal of air-borne populations of micro-organisms, pollen, and insects, the various aspects of the subject being discussed under the following headings: germ theory of disease and origin of life; sanitary air analysis; air-borne pollen dissemination; micro-organisms in the upper air; epidemiology of plant diseases; and insect population and migration in the air. A number of the papers included in the bibliography of 97 titles have been noticed in this *Review*.

KLECZKOWSKI (A.). **Quantitative studies on the serological reactions of some plant viruses and of a Pea nodule bacterium (Rhizobium leguminosarum).**—*Brit. J. exp. Path.*, xxii, 1, pp. 44–58, 3 graphs, 1941.

A tabulated account is given of the writer's studies at the Rothamsted Experimental Station on the serological reactions to definite weights of the tobacco mosaic and tomato aucuba mosaic and bushy stunt viruses in the liquid crystalline state, prepared by precipitation methods as described by Bawden and Pirie [*R.A.M.*, xix, p. 232], as well as of a strain of the pea nodule bacterium, *Rhizobium leguminosarum*, and of cross-reactions between the tobacco and aucuba mosaic viruses.

An aucuba mosaic virus antiserum contained antibodies reacting with the homologous virus but not with that of tobacco mosaic, in addition to those reacting with both viruses, whereas all the antibodies in a tobacco mosaic virus antiserum reacted with both viruses.

Fewer differences than might have been expected were found between the serological behaviour of the rod-shaped tobacco and aucuba mosaic viruses on the one hand, and the spherical bushy stunt on the other, none, in fact, in the region of antibody excess. In antigen excess, however, some four times the weight of precipitate can be obtained with the tobacco mosaic as with the bushy stunt virus. Maximal precipitate with the former was likewise obtained in much greater excess, about 30 times the amount of virus needed for equivalence compared with 1·5 times for the latter.

KREUTZER (W. A.), BODINE (E. W.), & DURRELL (L. W.). **A sexual phenomenon exhibited by certain isolates of Phytophthora capsici.**—*Phytopathology*, xxx, 11, pp. 951–957, 2 figs., 1940.

This is an expanded account of the writers' studies on the factors governing sexual reproduction in *Phytophthora capsici* in Colorado, a note on which has already appeared [*R.A.M.*, xx, p. 44]. Oospore formation resulted only from the pairing of cultures from a wilted chilli stem and a decaying cucumber fruit, no such phenomenon being observed when two chilli or two cucumber isolates were paired. Three out of four cultures (two from cucumber and one from chilli) produced oospores after 6 to 8 months of separate growth, the chilli isolate utilizing only potato dextrose agar for this purpose and those from cucumber bean pods. The average diameter of the oospores of the two cucumber isolates and one from chilli were 27·9, 26·9, and 30·5 $\mu$, respectively. The optimum temperature for sporangial development in all the isolates under investigation was close to 30° C.

LING (L.) & YU (E. H.). **Thermal death point of fungi in relation to growing conditions.**—*Phytopathology*, xxxi, 3, pp. 264–270, 1 graph, 1941.

In laboratory experiments at the Szechuen Provincial Agricultural Improvement Institute, Chengtu, China, the thermal death points of beef peptone broth spore suspensions at $P_H$ 6 of *Colletotrichum nicotianae*, *C.* [*Glomerella*] *gossypii*, and *C. glycines* were determined as 44° to 50°, 48° to 52°, and 48° to 51° C., respectively. In tests in which the reaction of the medium was modified, it was found that conditions favourable to fungus growth generally induced resistance to heat in the conidia. Nutritional factors appeared to be of little importance in relation to thermal resistance in the species under observation, except that *C. nicotianae* succumbed to 46° on potato dextrose agar compared with 49° for complete Richards's medium and the same minus potash and 50° for Richards's medium minus phosphorus.

RAMAKRISHNAN (T. S.). **Studies in the genus Colletotrichum. 1. Saltation in Colletotrichum capsici (Syd.).**—*Proc. Ind. Acad. Sci.*, Sect. B, xiii, 1, pp. 60–70, 1 pl., 1941.

A study of saltation in *Colletotrichum capsici* from wilting safflower (*Carthamus tinctorius*) in India, based on the parent strain C, and four saltants, $C_1$, $C_2$, $C_3$, and $C_4$, showed that C, $C_1$, and $C_4$ gave numerous appressoria. In $C_3$ these were less frequent, and in $C_2$ they were generally lacking. In the saltants the acervuli were smaller than in the

parents, varied in colour, and were sometimes clustered together. Black stromatoid bodies were formed abundantly, particularly in C and $C_3$; in $C_1$ and $C_4$ they were less numerous, and lighter-coloured. In general, they resembled the stromatic base of the acervuli, but were without conidiophores and conidia, though sometimes bearing setae. The greatest variation appeared in the setae, which in C and $C_3$ were either elongated, blackish-violet, thick at the base and tapering towards the apex, or less deeply coloured, and with a much lighter, rounded apex. Some of the setae of C showed the formation from the terminal portion of a cluster of hyaline or slightly coloured branches resembling the conidiophores, and from the tips of which spores developed. In $C_1$ and $C_4$ the setae were fewer, smaller, and lighter, and only one or two (or none) were present in each acervulus. Variation was also observed in the colour of the spore masses, in sporulation (none in $C_2$), and spore size.

The different forms betrayed marked differences in pathogenicity. For instance on *Cicer arietinum* C and $C_3$ produced a black rot of the tissues, which killed the plants, while with $C_2$ only one plant became affected and the infection failed to spread. On both hosts $C_2$ failed to produce acervuli whereas C and $C_3$ developed them conspicuously, $C_1$ less prominently. C showed a close similarity to *C. capsici* from diseased *Capsicum annuum* fruits in morphological, cultural, and pathogenic characters, and is therefore referred to this species.

Schultz (E. S.), Clark (C. F.), & Stevenson (F. J.). **Resistance of Potato to viruses A and X, components of mild mosaic.**—*Phytopathology*, xxx, 11, pp. 944–951, 1940.

It has been experimentally shown that on the basis of symptomatology the reactions of potato seedling varieties to virus X [*R.A.M.*, xviii, p. 544; xx, p. 273] may be classified as (*a*) symptomless carriers, (*b*) necrotic, (*c*) light green and slightly rugose, and (*d*) faintly mottled. On the basis of resistance to virus X, the varieties may be grouped as (*a*) immune, (*b*) rarely infected, and (*c*) easily infected. The corresponding reactions to virus A may be expressed on a symptomatology basis as (*a*) necrotic, (*b*) pale green and rugose, and (*c*) mottled, while on the basis of resistance to virus A the categories are the same as already defined in respect of X. The resistance reaction of the parents to virus A or X is transmitted to a high percentage of the progeny of crosses, especially in the case of two resistant progenitors. Earlaine, Katahdin, and S 24642 are immune from virus A by aphid infection but susceptible to it by grafting. These varieties apparently segregate for resistance and susceptibility to virus A in crosses with non-resistant varieties. Progenies of virus X-immune × virus A-immune have been developed combining immunity from both viruses and should play an important part in the control of mild mosaic, of which these viruses are components.

Sanford (G. B.) & Clay (S. B.). **Purple dwarf, an undescribed Potato disease in Alberta.**—*Canad. J. Res.*, Sect. C, xix, 3, pp. 68–74, 4 pl., 1941.

During the last ten years a potato disease, apparently hitherto undescribed, and for which the name 'purple dwarf' is suggested, has

developed in many fields in southern, central, and north-central Alberta. It seems to affect all districts equally, but has not so far seriously reduced yield; the number of affected plants seldom exceeds 1 per cent., and while in a few cases infection has reached 5 per cent., many fields appear to remain unaffected. All varieties seem to be susceptible.

Affected plants are readily recognizable as they emerge from the affected seed pieces, being stunted, rigid, brittle, and frequently dark green. The sprouts may remain abortive and die. General stunting and distortion, with the early development of a purple colour, especially on the margins of the apical leaves, are invariably present under field conditions. The underground parts are at first apparently normal, but before long the older roots, then the stolons, and finally the epidermis of the lower stem turn brown and decay, discoloration starting at the extreme base of the stem and spreading outwards through the roots and stolons and upwards through the stem. The outer part of the brown roots and stolons may easily be slipped off. Tubers from affected plants are seldom over one inch in diameter, and as a rule only a very few small ones, or none, develop. These tubers always show severe necrosis. The stolons and tubers give no secondary growth, and the parent set usually remains sound.

Under field conditions, the pith of the stem remains normal to dark green in colour, and sound until the disease is well advanced, when general disorganization may begin at the base of the stem, following bacterial and fungal infection. In the tuber and upper stem the pith usually remains normal. The phloem throughout the stems, stolons, and roots is discoloured and often plugged with a material staining deeply with sudan III. A marked browning of the exterior of the vascular cylinder is a characteristic symptom in the lower stem, stolons, and roots.

Experimental evidence and field observations strongly indicated that transmission occurs through affected tubers. All the affected plants examined in commercial fields had originated from affected tubers. Also, the condition was transferred to the stem of healthy potato plants by inserting a piece of petiole from affected potato plants. Furthermore the tissue of purple dwarf plants yielded neither bacteria nor fungi. On these grounds, therefore, the disease is considered to be of virus origin.

**Incidence of Potato late blight in 1940.**—*Plant Dis. Reptr*, xxiv, 22, pp. 452–460, 1940. [Mimeographed. Received May, 1941.]

In these notes on the potato late blight (*Phytophthora infestans*) situation in different parts of the United States in 1940, O. D. Burke states that in Pennsylvania an interesting development in regard to control is the organization of 'spray rings'. Farmers have banded themselves together in groups of 30 to 60, representing 150 to 250 acres of potatoes. They have agreed to have their acreage sprayed at a definite charge ($1·50 to 1·75) per acre per application, throughout the growing season, materials and water being provided by the operator. The area affected by this type of organization grew from 640 acres in 1939 to well over 3,000 acres in 1940. Spray machines on rubber-tyred tractors are used. Both 8- and 10-row booms with 3 nozzles per row and pumps delivering 20 to 30 gals. per minute proved satisfactory. All

operators of the spray machines in these rings follow the official control recommendations.

R. A. Jehle noted that in yield test plots in Maryland much late blight tuber rot occurred in an unsprayed plot, though virtually no infection was noted on the vines. In one field in Anne Arundel county little infection was found in the tops of the Sequoia variety, but late blight tuber rot was very prevalent in a part of the field were there was clay soil. U.S.D.A. seedling 46464 (a cross between McCormick and Katahdin), planted next to Sequoia in the heavy clay part of the field, showed only one affected tuber.

R. E. Vaughan and J. W. Brann draw attention to the fact that in the Langlade and Oneida County areas of Wisconsin 12 applications of Bordeaux mixture were required to keep the foliage properly protected.

NAOUMOFF (N. A.), VESSELOVSKY (I. A.), & KAMERAZ (A. Y.). Рак Картофеля [Potato wart].—112 pp., 17 figs., Госуд. Издат. колх.-совх. Литер. „Сельхозгиз". [State Publ. Off. Lit. collect. co-op. Farming 'Selkhozgiz'], Leningrad, 1940. Roub. 1. Kop. 35.

In this popular booklet on the wart disease of potatoes (*Synchytrium endobioticum*), it is stated that the disease has not so far been found in the U.S.S.R., but it is known to occur in the newly acquired territories formerly belonging to Finland (in Carelia) and Poland (White Russia and the Ukraine).

PERSON (L. H.) & MARTIN (W. J.). **Soil rot of Sweet Potatoes in Louisiana.**—*Phytopathology*, xxx, 11, pp. 913–926, 6 figs., 1940.

A description is given [without a Latin diagnosis] of *Actinomyces ipomoea* n.sp., the causal organism of soil rot, a very serious disease of sweet potatoes in Louisiana [*R.A.M.*, viii, p. 598], especially under dry conditions and in soils with a $P_H$ value above 5·2, first observed in the State in 1934 and characterized by dwarfing of the plants, decay of the root system, small, dark, elongated lesions on the stems below soil-level, and pits, $\frac{1}{4}$ to over 1 in. in diameter with uneven margins, on the mature tubers. The fungus is considered by Waksman to be distinct from *A. poolensis* and is distinguished on dextrose-casein agar by oval to elliptical conidia, 1·3 to 1·8 by 0·9 to 1·3 $\mu$, occurring in partly spiral-shaped chains; the mycelium on dextrose, egg albumen, and starch agars is white to bluish-green, the colour of the colonies on different media ranging from cream, through new silver, dawn grey, olive-yellow, and light brown to argus brown (Ridgway); gelatine is liquefied and milk hydrolysed; nitrites are formed in fair abundance on glycerine synthetic solution and nitrate broth. The optimum temperature for growth is about 32° C.

A simple and practical method of testing the virulence of isolates of *A. ipomoea* in the laboratory is described. Soil inoculation experiments with pure cultures of the fungus on Puerto Rican sweet potatoes gave positive results in the greenhouse and field.

VAN DER VEEN (R.). **Zonnebrand bij Hevea.** [Sun scorch of *Hevea*.]—*Bergcultures*, xv, 11, p. 314–317, 1 diag., 1941.

During the very dry season of 1940, the writer investigated an exceptionally large number of cases of associated sun scorch and infection

by *Botryodiplodia theobromae* among *Hevea* rubber seedlings and one-year-old or older bud grafts in the Besoeki district of Java [*R.A.M.*, xiii, p. 160], where the BD. 5 selection proved to be the most susceptible, Tjir. 1, AV. 255, LCB. 1320, and PR. 107 also suffering to a lesser extent, except in very sandy soils, while PR. 7 was exempt from the trouble. The disturbance most commonly assumed the form described by Sharples (Diseases and pests of the rubber tree, p. 352) [ibid., xvi, p. 60] as 'spear-head wounds', ranging in length from a few cm. to over 1 m., and occurred in all degrees of severity, from small, discoloured patches on the outermost bark of the side of the tree facing west and exposed to the sun's rays at the midday during the critical period for the development of the injury, to necrotic areas involving three-quarters of the cortex and a large portion of the wood at the base of the graft. Sun scorch and its attendant fungal infection are ordinarily confined to the dry period of the east monsoon on soils of slight moisture-holding capacity, and may be entirely prevented by whitewashing the stems and thereby reducing the surface temperature from 60° C. on a dark ground to 42°.

**Onderzoekingen over vlekkenkanker en lumpkanker bij Hevea in Indo-China.** [Investigations on patch and lump canker of *Hevea* in Indo-China.]—*Bergcultures*, xv, 6, pp. 160–161, 1941.

This is a résumé (signed 'Pr') of two papers by L. Roger, published by the Indo-China Institute of Agricultural Research, dealing with patch and lump canker of *Hevea* rubber in that country. The term 'patch canker' is not strictly applicable to the form of the disease occurring in Indo-China, where *Pythium complectens* [*R.A.M.*, xviii, pp. 265, 472] is the agent of infection, but the control measures recommended (precautions in connexion with tapping operations, excision of the invaded area, and disinfection with formalin of the resultant wound, which should then be covered with green petrolatum vaseline or a vaseline and coal tar mixture), are similar to those practised against *Phytophthora palmivora* in the Dutch East Indies [ibid., xvi, p. 634 *et passim*]. The first symptom of attack by *Pythium complectens* is a greyish-yellow, brown-edged discoloration of the bark, later turning wine-coloured, mauve, purple, or variegated, and ultimately becoming uniformly brown and somewhat moist. The coagulation of the latex below the loosened bark in malodorous, oval lumps, yielding to pressure and measuring up to 20 by 15 cm., gradually results in the rupture of the cortex. Infection is stated to originate in the inner bark and proceed outwards; the slimy, red exudate characteristic of the disease in Malaya is rarely observed in Indo-China. The most severe infections are those situated on the root-collar, whence spread to the lateral roots is frequent and girdling of the tree rapidly ensues.

Kanivetz (I. I.), Chariton (J. G.), & Tultshinskaya (Mme E. M.). **Ertragssteigerung bei Zuckerrüben, Hafer und Lupine bei verschieden starker Impfung des Bodens mit dem Pilz Trichoderma lignorum.** [Yield increase in Sugar Beets, Oats, and Lupins through the inoculation of the soil with varying amounts of the fungus *Trichoderma lignorum*.]—*Microbiology*, ix, pp. 143–151, 1940. [Russian. Abs. in *Chem. Zbl.*, cxi (ii), p. 2075, 1940.]

In experiments in boxes filled with medium podsol soil and kept in the

open at the Pan-Russian Institute for Sugar Industry, Kieff, the following yields were obtained following inoculation with a triple dose of *Trichoderma lignorum* [*T. viride*]: sugar beets 115 per cent. over the controls, oats 128 per cent.; with the same plus *Aspergillus niger* the figure for sugar beets was 109 per cent. [*R.A.M.*, xx, p. 381]. The structural consolidation of the soil was greatly furthered by the admixture of the fungus: thus, the accession of aggregates of >0·25 mm. amounted to 68 and 27 per cent. in beets and oats, respectively, with a triple dose. A suitable standard rate for the incorporation of *T. viride* into the experimental soils was found to range from 20 to 60 kg. per ha.; uniform distribution is important.

WAKSMAN (S. A.) & WOODRUFF (H. B.). **Actinomyces antibioticus nov. sp., a new antagonist against micro-organisms.**—Abs. in *J. Bact.*, xli, 1, pp. 32–33, 1941.

The *Actinomyces* recently isolated from soil at the New Jersey Agricultural Experiment Station and reported as antagonistic to other soil micro-organisms [*R.A.M.*, xx, p. 177] is named *A. antibioticus* n.sp. [without a Latin diagnosis] and referred to the chromogenic Actinomycetes, producing dark brown to black pigments in protein- or peptone-containing media. The active substance secreted by the organism, actinomycin, is highly pathogenic to (laboratory) animals. It forms orange-red crystals, soluble in ether, alcohol, and other organic solvents, but not in ether and only sparingly so in water, and is thermostable, resisting 30 minutes' boiling in neutral or slightly acid solutions.

DENNIS (A. C.) & DENNIS (R. W. G.). **Boron and plant life—part IV. Developments in agriculture and horticulture, 1939–40.**—*Fertil. Feed. St. J.*, xxv, 23, pp. 391–392, 394; 24, pp. 407–408, 410; 25, pp. 423–424, 426–427; 26, pp. 439–440, 6 figs., 1940; xxvi, 1, pp. 4–5; 2, pp. 15–17; 3, pp. 33, 35; 4, pp. 47, 49–50, 5 figs., 1941.

This is a review of research work carried out from the end of 1938 to the middle of 1940 on the problem of the boron requirements of plants [*R.A.M.*, xviii, p. 613], the two main aspects of which engaging the attention of workers having been the function of the element in the plant and the conditions under which it exists in the soil.

BURGESS (A. H.) & SMITH (G.). **Mould fungi as a possible cause of deterioration in stored Hops.**—*J. Inst. Brew.*, N.S., xxxviii, 3, pp. 53–55, 1941.

Under the Institute of Brewing Research Scheme a joint investigation was undertaken at the South-Eastern Agricultural College, Wye, Kent, and the London School of Hygiene and Tropical Medicine to determine the part played by moulds in the loss of preservative resins in commercially stored hops, and to ascertain the conditions of storage necessary to obviate such spoilage [*R.A.M.*, xv, p. 315]. Freshly picked hops were found normally to carry spores of a large number of moulds, an appreciable number of which survive drying, while further infection is apt to occur on the cooling floor, especially in windy weather. *Cladosporium herbarum*, a species commonly associated with aphid infestation and detected in the majority of green hop samples, was usually

completely eliminated by drying. The spores of various species of moulds were found to remain viable in stored hops for periods up to at least two years, but these are, of course, innocuous unless conditions favouring germination develop. Cases of actual mould growth on hops in the pocket are rare, and all those encountered during the present studies occurred on damp material.

Two experiments were conducted in which several hills of Fuggles hops were sprayed, a few weeks before picking, with aqueous suspensions of the two species of *Penicillium* most commonly observed on green hops, viz., *P. cyclopium* and *P. expansum*, the former alone being used in 1937 and both in 1938. *P. cyclopium* made vigorous growth on the sprayed bine cones in 1937 (a season of severe aphid attack), and analysis immediately after picking showed a decrease in $\alpha$-resin from 7·3 to 5·3 per cent. and in preservative value from 10·8 to 8·5 per cent. compared with control samples from the same garden. In 1938, when aphids were much less troublesome than in the previous year, none of the sprayed hops showed any obvious signs of mouldiness at picking, and those inoculated with *P. cyclopium* gave no evidence of the presence of mycelium, nor were the spore counts significantly high. *P. expansum* made slight growth on the inoculated samples, and analysis revealed a slight but significant fall in the $\alpha$-resin content from 6·2 to 5·4 per cent., corresponding to a decrease in preservative value from 9·5 to 8·6 per cent. Further experiments are obviously required.

In tests in a specially constructed chamber permitting of the exposure of relatively large hop samples to an atmosphere of constant humidity, with moisture contents up to 10 per cent. (a figure fairly representative of commercial storage conditions), no evidence of growth could be obtained with any of the 12 species of moulds used. In the presence of 12 per cent. moisture, two species of *Aspergillus*, *A. repens* and *A. ruber*, grew fairly well but did not reduce the preservative value of the treated samples. Pending further and more extensive experiments along these lines, it seems reasonable to conclude that the limit of safety for freedom from mould growth is not much below 12 per cent. moisture, so that under average storage conditions the organisms in question are not likely to constitute a serious source of deterioration.

Hesler (L. R.). **Notes on southern Appalachian fungi.**—*J. Tenn. Acad. Sci.*, xvi, 1, pp. 161–173, 9 figs., 1941.

This is a critically annotated list of 74 fungi collected during the past two years in eastern Tennessee and western North Carolina, among which may be mentioned *Sphacelotheca holci* and *Uromyces andropogonis* on *Sorghum halepense* (the latter verified by G. B. Cummins *in litt.* as a new host record), and *Pucciniastrum americanum* on *Ribes strigosus* [ibid., xv, p. 250.]

Cooke (W. B.). **Additions to the host index of fungi of Mount Shasta, California.**—*Plant Dis. Reptr*, xxv, 2, pp. 61–62, 1941. [Mimeographed.]

A number of further records are added to the author's host index of fungi of Mount Shasta, California [*R.A.M.*, xx, p. 136], a few corrections in which have also been necessitated by subsequent investigations.

SMIRNOVA (Mme. W. A.). **Die Abhängigkeit des Titers des Tabakmosaikvirus von den Ernährungsbedingungen der Pflanze.** [The dependence of the titre of the Tobacco mosaic virus on the nutritional conditions of the plant.]—*Microbiology*, ix, pp. 182–187, 1940. [Russian. Abs. in *Chem. Zbl.*, cxi (ii), 14, p. 1885, 1940.]

In tomato plants grown in phosphorus- or nitrogen-deficient soil the titre of the tobacco mosaic virus was equal to, or higher than, that in plants receiving normal supplies of nutrient substances. However, despite the heavy accumulation of infective material the disease assumed only a mild form in plants deprived of phosphorus. Plants receiving an excess of nitrogen accumulated more of the virus than those from which this element was withheld.

WENZL (H.). **Sclerotinia minor als Erreger einer Stengelfäule der Tomaten.** [*Sclerotinia minor* as the agent of a Tomato stem rot.]—*NachrBl. dtsch. PflSchDienst*, xx, pp. 23–24, 2 figs., 1940. [Abs. in *Zbl. Bakt.*, Abt. 2, ciii, 6–8, p. 125, 1941.]

Tomatoes in Vienna market-gardens are stated to be subject to a stem rot caused by *Sclerotinia minor* and involving the whole plant in wilting, yellowing, and gradual necrosis. Sections through a diseased stem reveal numerous sclerotia and remnants of mycelium, which may also occasionally be observed on the exterior. So far the incidence of infection has only been sporadic.

GREEN (D. E.). **Hygiene in the war-time vegetable garden. V.**—*J. R. hort. Soc.*, lxvi, 5, pp. 168–173, 5 figs. (facing p. xliii), 1941.

Continuing his instructions on the care of war-time allotments [*R.A.M.*, xx, p. 238], the writer briefly describes the symptoms and discusses the control of damping-off (chiefly *Phytophthora parasitica*) [ibid., xx, p. 182], foot rot (*P. parasitica* and *P. cryptogea*), root rots of diverse origin, wilt (*Verticillium albo-atrum*) [ibid., xx, p. 93], leaf mould (*Cladosporium fulvum*), blight (*P. infestans*), and grey mould (*Botrytis cinerea*) of tomatoes.

TRUE (R. P.). **Ceratostomella ulmi isolated from Elm wood of dish crates imported from England.**—*Plant Dis. Reptr*, xxv, 2, p. 55, 1941. [Mimeographed.]

*Ceratostomella ulmi* has recently been isolated in pure culture from elm wood used in the crating of dishes imported from England and intercepted at the Port of New York. In view of the ease with which the fungus may be carried in the round, half-round, or split uprights and side pieces, usually of green wood, composing the crates, efforts have been made to prevent the use of elm wood for this purpose.

COLLINS (D. L.), PARKER (K. G.), & DIETRICH (H.). **Uninfected Elm wood as a source of the bark beetle (Scolytus multistriatus Marsham) carrying the Dutch Elm disease pathogen.**—*Bull. N.Y. St. agric. Exp. Sta.* 740, 14 pp., 1 fig., 1940.

Up to 15 per cent. of the specimens of *Scolytus multistriatus* collected in the field in the south-east of New York State were found by culturing to be harbouring the Dutch elm disease pathogen, *Ceratostomella ulmi*

[*R.A.M.*, xx, p. 94 and preceding abstract]. When cultured immediately on emergence from diseased wood, as many as 100 per cent. of the beetles were positive for the fungus, but usually the average was well under 50 per cent.

When beetles artificially inoculated with spores were allowed to enter healthy wood, up to 74 per cent. of their progeny emerged carrying the spores of *C. ulmi*. Sound cut logs exposed to normal beetle infestation in the field produced up to 62 per cent. of insects positive for the fungus among the progeny of parents probably averaging much lower on entrance, while pieces of uninfected beetle infested wood collected in the open yielded as many as 25 per cent. of beetles carrying the elm parasite. 'Positive' beetles were also produced by diseased wood cut in short lengths and piled (16 and 9 per cent. stored out-of-doors and in sheds, respectively), the corresponding figures for healthy wood exposed to the ingress of spore-bearing insects being 14 and 19 per cent., respectively.

Out of 217 diseased trees inspected in 1939 in Ulster, Columbia, and Dutchess counties, representing the peripheral regions of the infected zone, 127 were shown to have contracted infection in the same year, and near 65 of these trees uninfected wood that had produced *S. multistriatus* in the spring or early summer was detected, suggesting a definite correlation of beetle emergence and feeding with the probable time of infection. From the fact that uninfected wood frequently produces spore-carrying beetles, it is argued that dead or dying elm wood of whatever origin, if suitable as a breeding-ground for the elm bark beetle, is a potential source of inoculum from which the fungus may be disseminated by the emerging progeny. It is evident, if this hypothesis be accepted, that such wood not only acts as a reservoir for the local spread of *C. ulmi*, but may also serve as a bridge for its transference to hitherto uninvaded areas.

Roth (E. R.). **Top rot in snow-damaged Yellow Poplar and Basswood.**—*J. For.*, xxxix, 1, pp. 60–62, 1941.

In June, 1939, yellow poplars (*Liriodendron tulipifera*), basswood (*Tilia glabra*), and other hardwoods (300 in all) at the Appalachian Forest Experiment Station, West Virginia, damaged by snow, in October, 1935, were examined for top rot in connexion with cordwood thinning studies. Most of the 27 per cent. injured *L. tulipifera* trees showed the presence of active decay in the stems. Nine out of 18 specimens of a soft, spongy, white rot of this host yielded *Collybia velutipes* [*R.A.M.*, xii, p. 44] (identified by R. W. Davidson), which usually involved the entire cylinder of heartwood, and in a few cases had penetrated the bole for a distance of 72 in. and induced discoloration to a depth of 90 in. The rot was found to extend about three times as fast down the stem as upwards, the area involved in discoloration being about twice as large as that actually decayed. Pure cultures of wood-decaying fungi could not be obtained from *T. glabra*, notwithstanding the presence of obvious rot in the stems.

Pirone (P. P.). **Bleeding canker of Maple in New Jersey.**—*Plant Dis. Reptr*, xxiv, 23, pp. 476–478, 1940. [Mimeographed.]

Bleeding canker due to a *Phytophthora* identified by C. M. Tucker as

*P. cactorum* [*R.A.M.*, xix, p. 570] was found by the author on a 25-year-old Norway maple [*Acer platanoides*] at Bernardsville, New Jersey, in October, 1940, this being the first record of the disease for that State. The most conspicuous symptom was a pinkish ooze emanating from some 20 bark fissures round the base. No pronounced canker was visible, but the inner bark was reddish-brown and appeared water-soaked when cut. The sapwood underlying the affected part was reddish-brown and had a deep olive-green margin. The discoloration extended to a depth of several annual rings. No effective control measures are yet known.

Campbell (W. A.) & Davidson (R. W.). **Red heart of Paper Birch.**—*J. For.*, xxxix, 1, pp. 63–65, 1 graph, 1941.

*Torula ligniperda* [*R.A.M.*, xix, p. 315] was isolated from 80 per cent. of the samples of red heart of paper birch (*Betula papyrifera*) in five plots in Massachusetts in 1937, and is thought to be one of the causes of the condition, which occurred in approximately equal amounts in seedlings and sprouts (rather more in the former). The defect was generally more prevalent in trees invaded by wood-rotting fungi than in sound ones, but in trees 50 years old it was present in practically all, regardless of condition.

Ledeboer (M. S. J.). **Developments in pathological research on Wattles.**—*J. S. Afr. For. Ass.*, *1940*, 2, pp. 28–45, 5 figs., 1940.

From this tabulated discussion of the writer's studies on certain pathological conditions of wattles [*Acacia mollissima* and *A. decurrens*] in South Africa, it appears that no organism has been consistently isolated from the tissues of trees suffering from gummosis [*R.A.M.*, xix, p. 502], while inoculation experiments with *Bacterium acaciae* Greig Smith and *Diplodia natalensis* have so far given negative results. The same applies to the bark-grafting tests undertaken with a view to the detection of possible virus infection. Studies are now in progress to determine the effects of mineral deficiencies on wattles, and to ascertain the part played by nodule bacteria in the development of the seedlings under varying nutritional conditions.

No further progress has been made in the knowledge of the etiology of the 'Albert Falls' disease [loc. cit.].

Root collar rot [loc. cit] occurs in most plantations though seldom on so devastating a scale as the above-mentioned diseases. Affected trees show a blackening, cracking, and gumming of the bark at the base, decay of the root collar, and eventually are wind-thrown. The disease is associated with a fungus provisionally identified as *Rhizoctonia* which is prevalent in the early stages. Inoculation experiments are in progress.

Garren (K. H.). **Fire wounds on Loblolly Pine and their relation to decay and other cull.**—*J. For.*, xxxix, 1, pp. 17–22, 1 graph, 1941.

Wood-rotting fungi [unspecified: cf. *R.A.M.*, xviii, p. 561] were found to be the most important agents of cull in loblolly pines (*Pinus taeda*) following fire injuries in Alabama, other contributory factors being the presence of large amounts of resin in the wood and insect

infestation. Of 2,703 felled trees in six localities, 16 per cent. showed one or more fire wounds, of which those measuring 7 to 12 in. in width might have been expected to result in considerable cull after 30 years, and those over 12 in. after ten.

WATSON (ALICE J.). **Studies of Botryosphaeria ribis on Cercis and Benzoin.**—*Plant Dis. Reptr*, xxv, 1, pp. 29–31, 1941. [Mimeographed.]

On rough, sunken, blackened, cankers on the branches and trunks of *Cercis canadensis* in Maryland, North Carolina, and Virginia was found a species of *Botryosphaeria* which is identified on the basis of morphological and cultural characters as *B. ribis* [var.] *chromogena* [*R.A.M.*, iv. p. 178]. Similar cankers on a single spice bush (*Benzoin aestivale*) in Maryland yielded the same fungus in the pycnidial (*Dothiorella*) stage only. Inoculations through wounds carried out by Lucia McCulloch with the fungus at the Beltsville (Maryland) Horticultural Station gave positive results, *B. ribis* var. *chromogena* being reisolated from the infected tissues.

PIRONE (P. P.). **Canker of Red Bud in New Jersey.**—*Plant Dis. Reptr*, xxv, 3, pp. 95–97, 1941. [Mimeographed.]

Die-back of red bud (*Cercis canadensis*) in New Jersey is characterized by elliptical, sunken cankers, ½ to 2 in. in length, weakening and finally killing the branches. The fungus isolated from the diseased tissues forms a white, cottony aerial growth over a brownish-black substratum on potato dextrose agar. No spores have been produced to date but Miss Watson has referred the pathogen of red bud canker to *Botryosphaeria ribis* var. *chromogena* [see preceding abstract]. Inoculation experiments with fragments of agar containing the fungus on wounded and unwounded leaves, green shoots, or woody stems of *C. canadensis* and *C. chinensis* gave positive results in the case of injured surfaces only, the pathogen being reisolated from the diseased tissues. Pending further studies on control, the only advice that can be given is to cut back heavily cankered branches to the site of attachment to the trunk or larger branches, disinfecting all cut surfaces and applying a dressing of a good tree paint.

SECREST (H. C.), MACALONEY (H. J.), & LORENZ (R. C.). **Causes of the decadence of Hemlock at the Menominee Indian Reservation, Wisconsin.**—*J. For.*, xxxiv, 1, pp. 3–12, 5 figs., 1941.

Although *Armillaria mellea* was present in an active form on eastern hemlock (*Tsuga canadensis*) trees found to be infested by the borer *Melanophila fulvoguttata* in the course of an investigation on the Menominee Indian Reservation (230,000 acres) in 1939, the heavy mortality among the stands during the past three years, involving 50,000,000 board ft. of merchantable saw timber, is attributed in the first instance to the severe and protracted drought prevailing in the experimental area from 1930 to 1937.

STRONG (F. C.). **Root and butt rot in the Pinetum at Michigan State College.**—*Quart. Bull. Mich. agric. Exp. Sta.*, xxiii, 3, pp. 159–163, 4 figs., 1 diag., 1941.

In November, 1940, twelve white pine trees [*Pinus strobus*] in a

44-year-old plantation at East Lansing, Michigan, were partially or completely blown down by a gale and were found to have sustained severe infection by *Polyporus schweinitzii*. Four of the affected trees had snapped off from 6 in. to 3 ft. above ground-level and in one tree the heartwood was severely decayed to a height of over 10 ft. The evidence showed that spread had taken place from an affected tree to adjacent ones.

The available information indicates that more care should be used in selecting favourable sites for planting white pine, in order that stagnation of growth once the trees attain an age of 20 years or more may be avoided. Greater care in planting may also be advisable, to avoid producing 'soil-filled' pockets through which root infections may take place. From a purely silvicultural point of view, increase of vigour by thinning or fertilization would discourage spread to healthy trees but eradication of the diseased trees is not economically advisable. From an aesthetic point of view, it might be worth while to remove the affected trees, and treat the soil with carbon disulphide as for *Armillaria* root rot [*A. mellea*].

CHRISTENSEN (C. M.). **Observations on Polyporus circinatus.**—*Phytopathology*, xxx, 11, pp. 957–963, 4 figs., 1940.

In north-western Minnesota the writer has observed *Polyporus circinatus* to be prevalent on white spruce (*Picea glauca*) and to occur occasionally on black spruce (*P. mariana*), Jack pine (*Pine banksiana*), balsam fir (*Abies balsamea*), and red pine (*P. resinosa*) [*R.A.M.*, ix, pp. 148, 628]. In 1937 several groups of up to 50 trees each were found in which as many as 50 per cent. bore fructifications of the fungus, but in the two years preceding and the two following 1937 only a few scattered fruit bodies were detected. Microscopically the fungus is characterized by brown, pointed setae arising from coloured hyphae in the pore wall. They ranged in length from 23 to 79 (average 44) $\mu$ and the average length of 50 spores in each of three fruit bodies was 4·7, 4·7, and 5·2 $\mu$, respectively. The fungus makes good growth on malt or potato dextrose agar, producing a pale yellowish-brown to dark chocolate-coloured mycelium from which numerous chlamydospore-like enlargements develop after one to two months in culture. Evidence is adduced to establish the role of *Polyporus circinatus* as a primary cause of the premature stagnation and senescence, infecting trees 15 to 25 years old or even younger. The rotted wood shows the presence of pockets initiated most abundantly at the junction of the annual rings, but later distributed uniformly through the wood. All the wood elements are digested in the formation of the pockets and in the final stage of decay the wood is reduced to an interlacing network only.

BRAMBLE (W. C.) & HOLST (E. C.). **Fungi associated with Dendroctonus frontalis in killing Shortleaf Pines and their effect on conduction.**—*Phytopathology*, xxx, 11, pp. 881–889, 1 fig., 1 diag., 3 graphs, 1940.

A comprehensive, tabulated account is given of the writers' studies in North Carolina in 1932, 1934, and 1935 on the association of fungi with bark beetles, *Dendroctonus frontalis* (and *Ips* spp. in the later stages), in a widespread dying-off of shortleaf pines (*Pinus echinata*).

The organisms isolated on malt agar from cross-sectional blocks of the infested wood included *Ceratostomella pini*, *C. ips* [*R.A.M.*, xiv, p. 68], *Dacryomyces* sp., *Zygosaccharomyces pini* [ibid., xvi, p. 218], '*Monilia*' spp., *Trichoderma lignorum* [*T. viride*], and *Penicillium* spp., of which *Dacryomyces* sp., *C. pini*, and *Z. pini* may be termed 'primary invaders', gaining ingress to the bark within 24 hours of its tunnelling by the beetles and rapidly penetrating the sapwood, the heartwood being reached within a fortnight. These species are closely followed by '*Monilia*' spp. and *T. viride*, while the remaining fungi are restricted to the outer layers of sapwood. In inoculation tests, *C. pini* was the only one of the fungi capable of killing healthy trees from 2 to 6 in. in diameter at breast height, the corresponding measurement for *Dacryomyces* sp. being 1 to 2 in.; the other organisms gave negative results. Combined inoculations with different pairs of the fungi under investigation were no more effective than those with single organisms. The results of experiments, carried out by a method which involved following the course of a light green dye solution in the sapwood of severed stems inoculated with *C. pini*, *Dacryomyces* sp., *Z. pini*, and '*Monilia*' spp. showed that only the first-named is capable of extensive interference with the water conduction system, usually amounting to complete stoppage, the outer rings only being affected by *Dacryomyces*, while the other fungi were innocuous.

CRAIGHEAD (E. C.) & ST. GEORGE (R. A.). **Field observations on the dying of Pines infected with the blue-stain fungus, Ceratostomella pini Munch.**—*Phytopathology*, xxx, 11, pp. 976–979, 1940.

A table is presented showing the correlation of blue stain (*Ceratostomella pini*) of shortleaf pines [*Pinus echinata*] in Virginia in 1934 with infestation by the southern pine beetle (*Dendroctonus frontalis*) [see preceding abstract] during the previous year. On this occasion the insects were 'pitched out' and killed by the increased resin flow before they had time to construct their egg tunnels, and few reached the xylem, so that the blue-stain and wilting normally following rapidly on beetle invasion did not develop until the succeeding spring.

**Spread of White Pine blister rust during the calendar year 1940.**—*Plant Dis. Reptr*, xxv, 2, pp. 52–55, 1941. [Mimeographed.]

Details are given of new locations of blister rust (*Cronartium ribicola*) detected during 1940 on white pines or the alternate *Ribes* hosts [cf. *R.A.M.*, xviii, p. 562] in Virginia, West Virginia, Michigan, Minnesota, Iowa, Wisconsin, and California; in the last-named State the discovery of two infected sugar pines (*Pinus lambertiana*) in Shasta County (the first record for the locality) places the known southern limits of the rust about 107 miles south of the Oregon border [ibid., xviii, p. 3].

TOOLE (E. R.) & BUCHANAN (T. S.). **Little-leaf disease of Shortleaf and other southern Pines.**—*Plant Dis. Reptr*, xxv, 4, pp. 117–119, 1 map, 1941. [Mimeographed.]

Shortleaf pines [*Pinus echinata*], and to a lesser extent *P. taeda*, *P. australis*, and *P. virginiana*, have recently been observed to suffer from a disorder characterized by curtailment of the branch and twig

internodes, the foliage on which is very sparse and confined to the extremities. These symptoms are sometimes accompanied by chlorosis and shortening of the needles, marked reduction in the radial growth of the stem, and a progressive die-back of the crown from the base upwards. Only pole-size and larger trees are involved in this new trouble, the distribution of which extends roughly in a crescent-shaped belt from central Virginia southwards through western North and South Carolina and thence westerly across north-central Georgia and Alabama to north-eastern Mississippi, while a few cases have also been reported from Tennessee and Texas. In some districts the actual or anticipated mortality from little leaf has been sufficient to warrant abnormally heavy cutting of *P. echinata*, the continued use of which for planting programmes in areas within the range of the disease is further under discussion by certain agencies.

STRONG (F. C.) & CATION (D.). **Control of Cedar rust with sodium dinitrocresylate.**—*Phytopathology*, xxx, 11, p. 983, 1940.

Teleutospore germination from the rust galls of *Gymnosporangium juniperi-virginianae* and *G. globosum* on red cedar (*Juniperus virginiana*), and of *G. clavipes* and *G. clavariaeforme* on dwarf juniper (*J. communis*) [*R.A.M.*, xx, p. 23] was inhibited at the Michigan State College by the application to one group of trees on 8th May, and to another on the 16th, of 1 per cent. sodium dinitrocresylate (elgetol) [ibid., xx, p. 212]. The red cedars contracted no foliar injuries as a result of the treatment, which caused slight damage, however, to some badly infected dwarf junipers. The galls produced by *G. globosum* predominated on *J. virginiana*, up to 8,000 or 12,000 per tree being counted. On the sprayed portions of the trees the extension of the teleutosori came to a total standstill, while proceeding unchecked on the untreated upper parts. Elgetol is considered to be the most promising of the fungicides yet tested against the teleuto stage of the *Gymnosporangium* rust fungi and gives a new method of attack for the control of these fungi on Pomaceous hosts.

HAHN (G. G.). **New reports on Adelopus gäumanni on Douglas Fir in the United States.**—*Plant Dis. Reptr*, xxv, 4, pp. 115–117, 1941. [Mimeographed.]

Since the publication of Boyce's critical study of the needle cast (*Adelopus* [*Phaeocryptopus*] *gaeumanni*) on Douglas fir (*Pseudotsuga taxifolia*), in which information was presented concerning the distribution of the disease in the United States [*R.A.M.*, xix, p. 736], news has been received of its occurrence in a number of fresh localities in Connecticut, Maine, Massachusetts, New Hampshire, New York, Washington, Oregon, California, New Mexico, and Arizona.

ZUCKER (M.). **X-ray pole inspection a new engineering tool.**—*Elec. World, N.Y.*, cxiii, 12, pp. 33–35, 108–109, 7 figs., 1 graph, 1940.

The development of the technique for the X-ray inspection of electric distribution and transmission poles [*R.A.M.*, xx, p. 284] at the Detroit (Michigan) Edison Company is described, the method finally adopted being that of 'non-screen' radiography, the rays emerging from the pole

registering directly on specially sensitized films wrapped in light-proof paper. For field work the apparatus, a Westinghouse 'Diadex' machine, 85 kv., 15 milliamp. anode current, is mounted on a sliding shelf in a spring-supported cabinet near the tailboard of a pick-up truck, power being supplied by a 2 kw. 'Homelite' two-cylinder, air-cooled gasoline engine and single-phase, self-excited generator with 110 volts, 50 cycles, placed on coil springs behind the truck cab. In the matter of interpretation of the films, the structure of the fibre was found to be a better indicator of the condition of the wood than film density, sound material having precise, smooth-flowing boundary lines, which begin to waver and separate, slightly but unmistakably, as soon as decay starts to impair strength. The higher cost of X-ray inspections as compared with boring and probing tests has been justified by the saving in pole replacements, and the satisfactory degree of accuracy achieved by the new technique was verified in trials on northern cedar [?*Thuja occidentalis*] poles.

WALKER (J. C.). **Origin of Cabbage black rot epidemics.**—*Plant Dis. Reptr*, xxv, 3, pp. 91–94, 1941. [Mimeographed.]

The increasing economic importance of cabbage black rot (*Bacterium campestre*) [*Pseudomonas campestris*] is attributed largely to neglect of fundamental precautionary measures, including seed treatment [*R.A.M.*, xx, p. 239] in hot water, crop rotation, and seed-bed sanitation to eliminate the organism from diseased refuse, in which it may persist for at least a year; the symptoms due to early infections from this source may be masked during the cool initial stages of the growing period and thus escape attention until the development of active outbreaks with rising temperatures about heading time. In 1940 the disease was very severe in Wisconsin both on cabbage and cauliflower, causing 50 per cent. losses in many fields, while one 10-acre cabbage crop was a total failure. An untreated lot of Danish-grown Bugner seed produced infected plants, whereas adjacent stands raised from Puget Sound stock [loc. cit.] remained healthy. Cabbage plants transported from the south constitute a common source of infection in northern areas.

GODFREY (G. H.). **An outbreak of Cabbage black spot disease in the Lower Rio Grande Valley of Texas.**—*Plant Dis. Reptr*, xxv, 4, pp. 119–120, 1941. [Mimeographed.]

Black spot (*Alternaria brassicae* (Berk.) Sacc.) [used for *A. oleracea*: *R.A.M.*, vi, p. 202], which has been observed annually in a mild form on cabbage for the past four years in the Lower Rio Grande Valley of Texas, developed with extreme severity for the first time in the State early in the season of 1941, following abnormally heavy rains in December and January, reducing yields from the customary figure of 15 tons per acre to 3 or less. Taking 90 to indicate plants with the lower leaves spotted, 80 those with clean wrapper leaves but outer leaves considerably spotted, and so on, the average figures for eight varieties, based on individual records of 100 to 600 plants of each, were as follows: Allhead Select 68, Wisconsin Allseason 68, Globe 67, Penn State Ballhead 66, Midseason Market 60, Marion Market 59, Hollander 58, and Round Dutch 42.

Below 60 plants were totally unmarketable, while even 70 was doubtful owing to the presence of a few spots on the wrapper leaves.

Борьба с вредителями и болезнями Сахарной Свеклы. [Control of pests and diseases of Sugar Beet].—*Ex* Основные выводы научно-исследовательских работ ВНИС за 1938 год. [Main results of the scientific research work during 1938 of the Pan-Soviet Scientific Research Institute for the Sugar Industry (VNIS)], pp. 148–170, 5 figs., 2 diags., 1940.

In this collection of papers, arranged on similar lines to those of the previous year [*R.A.M.*, xix, p. 321], the following items are of interest.

Mme. N. I. SALUNSKAYA (pp. 162–163) states that Bordeaux mixture applied twice before and twice after the appearance of spots on the foliage reduced the field infection of sugar beet by *Cercospora* [*beticola*: loc. cit.] from a 1·24 to a 0·48 mark. Under conditions of very slight infection prevailing during 1938, the increase in yield resulting from three to four sprays of Bordeaux mixture amounted on the average to from 5 to 7 per cent. Field observations showed that the first spray is most effectively applied when the first lesions appear on the leaves, and that sprays should not be applied after sudden, transient rains which are usually followed by reduced atmospheric humidity, but rather after a period of prolonged wet weather lasting at least two to three days.

A. L. BOUZNITZKY's (pp. 164–165) biochemical studies showed that in leaves of sugar beets severely affected by *C. beticola* the peroxidase activity was about 1½ times to twice that of those only slightly affected, and that the latter had a higher content of total, soluble, and albuminous nitrogen, and a lower content of oxalic acid, particularly in insoluble form.

Mme. N. I. SALUNSKAYA (pp. 165–166) states that the formation of spores of *C. beticola* on leaves of sugar beet in the laboratory occurred at a relative humidity of above 90 per cent. and a temperature not below 9° C. Under optimum conditions of atmospheric humidity (97 to 100 per cent.) and temperature (25° to 28°), the spores formed within 15 to 17 hours, this period being much extended when the humidity and temperature were lowered. At low humidity, no conidia were formed on the lesions, whereas at high humidity conidiophores were produced after 10 hours.

K. I. VITAS (pp. 166–167) found that of the fungi causing storage rot of sugar beet [ibid., xix, p. 322], *Rhizopus* sp. is more suitable for use in resistance tests than *Botrytis cinerea*, as the latter tends to deteriorate and to lose its virulence in culture. *Rhizopus* sp., on the other hand, maintained its virulence, rapidly spread over the medium in the Petri dish, was not contaminated by other micro-organisms during the period of the test, and finally infected the plant material at a temperature of 20° to 22° so rapidly as to reduce the duration of the whole analysis by about half as compared with the *B. cinerea* tests. *Fusarium culmorum* [loc. cit.] did not deteriorate in culture, but developed more slowly than *B. cinerea* and was therefore often contaminated by other micro-organisms. Decayed beet heart should not be used in analysis owing to the varying infection by micro-organisms.

N. I. GOMOLYAKO (pp. 167–168) gives a preliminary description of a

method for the identification of spores of *Uromyces* spp. encountered in beet seed samples. The method consists in heating to boiling point spore preparations to which strong concentrations of caustic potash have been added; this results in a swelling of the spore walls followed by their characteristic splitting into layers. In spores of *U. betae* [ibid., xv, p. 400] the walls split into one thin inner and two outer layers, of which one was light- and the other dark-coloured; in spores of *U. pisi* and *U. rumicis* no splitting occurred, but the unevenness of the surface became accentuated; in spores of *U. trifolii* the effect on the outer layer was noticeable only at the top of the spore; in *U. fabae* the splitting was analogous to that in *U. betae,* while none was observed in *U. polygoni.*

A. Y. Ovtcharenko (pp. 168–169) states that the chief source of spring infection by *Peronospora* [*schachtii*: ibid., iv. p. 391] are diseased transplants; in 1938 diseased mother roots produced over 90 per cent. of diseased transplants. When sown near transplants, beets showed the highest proportion of infection at a distance of from 5 to 20 m., a small percentage still occurring at a distance of 500 m., but none at 1,500 m. Sowings should, therefore, not be made at a lesser distance than 1,500 m. from the transplants. In inoculation experiments infection resulted only from freshly gathered diseased leaves. The incubation period lasted for 5 to 14 days.

I. M. Krasnoshtshekoff and N. A. Ryakhovsky (p. 169) sum up the results of several years' tests for the control of *Ascochyta* [unspecified] in beets by the thermal method of seed treatment as follows. The best results were obtained by heating the seed for five minutes in hot water (50°) after pre-soaking it for 4½ hours in 25 per cent. water and 2 per cent. ethyl alcohol [? in proportion to the weight of seed]. Seeds thus treated showed the same amount and energy of germination as the untreated control lot, but the percentage of infection was reduced to between 0 and 2 as against 46. The importance of drying the seed after treatment thoroughly and quickly (within one to two days) is stressed, since it was found that poor stands were due to sowing moist seeds.

N. I. Gomolyako (pp. 169–170) gives the results of tests conducted in 1939 with a 'Jaeger' machine used for drying beet seeds treated with formalin against seed-borne diseases such as rust [*Uromyces betae*] and *Peronospora* [*schachtii*]. The machine had several minor disadvantages, but it was possible to dry in it formalin treated seeds of a humidity of 50 to 74·3 per cent. without preliminary drying, although very moist seeds had to be put through the machine several times. When dried at a temperature of 50° the seeds showed a germination of 91 per cent. as compared with 93 in the untreated control, while at higher temperatures (70° to 80°) the percentage was reduced to 72.

Reinboth (G.). **Die Cercosporabekämpfung bei den Rüben.** [*Cercospora* control in Beets.]—*Zuckerrübenbau,* xxiii, 1, pp. 10–12, 1941.

Great difficulty has been experienced in persuading Italian farmers to take any active steps for the control of leaf spot of sugar beets (*Cercospora beticola*) [*R.A.M.*, xvi, p. 362], especially in view of the rarity of severe epidemics of the disease and the tendency of mild attacks to increase rather than depress the sugar content. Spraying is now being

conducted with materials containing little or no copper but with the addition of citrus fruit essences, but attempts to combat the leaf spot along these lines have been very half-hearted, and the prospects of an energetic campaign against the pathogen are not encouraging. For a time interest was aroused by the resistant late-maturing varieties, which failed to hold their ground, however, against the superior commercial attractions of a 'bumper' summer harvest.

NEUWEILER (E.). **Neue Versuche über die Wirkung des Bors auf einige Feldgewächse.** [Further experiments on the action of boron on certain field crops.]—*Annu. agric. Suisse*, liv, 9, pp. 916–935, 1 fig., 1940. [French summary.]

The writer fully describes and tabulates the results of his further trials at the Federal Agricultural Experiment Station, Oerlikon, Zürich, from 1936 to 1938 to determine the value of boron in the control of heart rot of beets [*R.A.M.*, xv, p. 696] and its effects on swedes, potatoes, and celery. The outcome of the previous tests was fully confirmed, the beets treated with boric acid at doses of up to 12 kg. per ha. remaining healthy, while those receiving complete fertilizers from which the trace element was omitted contracted 75 to 100 per cent. heart rot. Chile saltpetre, which contains minute amounts of boron, failed to exert a definitely curative action on heart rot but proved to be a more suitable nitrogenous constituent of the complete fertilizer than synthetic sodium nitrate. The beneficial effects of boron treatment on swedes, Flava and Ackersegen potatoes, and celery were reflected in improved quality and heavier yields.

WHIPPLE (O. C.) & WALKER (J. C.). **Strains of Cucumber mosaic virus pathogenic on Bean and Pea.**—*J. agric. Res.*, lxii, 2, pp. 27–60, 15 figs., 1941.

In the course of studies in Wisconsin from 1935 to 1939 a virus affecting peas and another attacking both peas and beans were observed in nature. Both viruses were found to belong to the cucumber mosaic group and are referred to as strains 14 and 17 of that group. In greenhouse experiments strain 14 infected all 25 strains of bean (*Phaseolus vulgaris*) and the three varieties of pea tested with some varietal differences in the symptoms. Generally, the early symptoms produced by strain 14 on bean included the range described for both bean virus 1 and 2, but the drooping of the unifoliate leaves distinguished it from bean virus 2 and epinasty of the first trifoliate leaf from bean virus 1. Stunting, which becomes greater with age, was the most constant of the symptoms, others being an irregular glossy leaf surface, vein-clearing of younger leaves, and some necrosis or mottling. Masking of leaf symptoms in the greenhouse and field was commonly observed. On peas strain 14 produced first a wilting with necrosis or mottling, eventually causing premature death [cf. *R.A.M.*, xix, p. 561]. Strain 17 infected none of the beans tested while on all the three pea varieties it produced symptoms closely resembling those caused by strain 14 but with a more pronounced stem necrosis and showing vein-clearing of the young leaves more commonly than mottling. Neither cucumber virus 1 nor celery virus 1 produced systemic infection in the bean varieties, and only local symptoms in a few pea plants. Three substrains of 14 were

isolated, a 'yellow', a 'dark green', and a 'normal green' which produced distinct symptoms on tobacco, cucumber, bean, pea, and cowpea.

The most typical symptoms of strain 14 on peas and beans developed at 24° C. although the disease was most severe at 28°; at 16° all symptoms except epinasty and stunting were completely masked in bean leaves. The properties of strains 14 and 17 agreed in general with those described for other cucumber mosaic viruses. The thermal inactivation point (after 10 minutes' exposure) was about 65° for strain 14 and between 65° and 70° for 17. Both strains remained infectious *in vitro* for 7 to 8 days at 20° to 22°. The maximum dilution at which infection occurred was 1 in 1,000 for strain 17 and 1 in 10,000 for 14. Both strains were readily transmitted by *Myzus persicae* to and from several hosts, the incubation period in which ranged from 14 to 21 days. Mechanical transmission was also achieved with or without the use of carborundum powder as an abrasive. Strain 14 was not transmitted to the 580 pea and 440 bean seedlings grown from infected seed; no seed transmission trials were made with strain 17.

In comparative host range studies with cucumber virus 1 [ibid., vi, p. 501], and celery virus 1 [ibid., xiv, p. 4] [the results of which are fully tabulated] involving 19 species of plants belonging to 16 genera of 6 families, both strains infected all plants susceptible to cucumber virus 1 and, in addition, strain 14 infected Lima bean (*P. lunatus*) and both attacked yellow sweet clover (*Melilotus officinalis*). Strain 17 differed from cucumber virus 1 only in causing systemic infection in pea, *Datura stramonium*, and *M. officinalis*. The symptoms produced by strains 14 and 17 were in some hosts similar to those produced by cucumber virus 1, while in others certain differences were evident. The host range of strain 14 closely agreed with that of celery virus 1, but each virus infected several hosts not infected by the other. None of the four viruses tested was able to infect White Dutch clover (*Trifolium repens*) or soybean. Preliminary tests seemed to indicate that zinnia plants infected by strain 14 are immune from other strains of cucumber mosaic virus, thus demonstrating its place in the cucumber mosaic group.

It is stated that strains 14 and 17 may be separated from mixtures with bean viruses 1 and 2, and pea viruses 1, 2A, 2B, and 2C by inoculation to either tobacco or tomato, and vice versa that any one of the five last named viruses can be isolated by transfer to broad bean. The strains 14 and 17, cucumber virus 1, and celery virus 1 cannot be completely separated from one another when present in admixture, except in certain combinations. Thus strain 14 can be isolated from any of the others by inoculation into kidney bean, cowpea, or Fordhook Mammoth Pod Lima bean; strain 17 cannot be separated from a mixture with strain 14, but can be isolated from the other two by inoculation to garden pea or yellow sweet clover; celery virus 1 can be freed from the other three by inoculation to broad bean (*Vicia faba*), but cucumber virus 1 cannot be separated from the others by the methods employed.

Kreutzer (W. A.), Bodine (E. W.), & Durrell (L. W.). **Cucurbit diseases and rot of Tomato fruit caused by Phytophthora capsici.**—*Phytopathology*, xxx, 11, pp. 972–975, 1 fig., 1940.

An account is given of investigations to date, mainly in Colorado, on

the decay of cucumber and tomato fruits and the wilt of squash (*Cucurbita maxima*) and watermelon vines caused by the agent of chilli blight (*Phytophthora capsici*) [see above, p. 317]. All the diseases are of a serious nature and have been responsible for heavy losses among the affected crops of recent years. The fungus was isolated from each host and experimentally shown to be pathogenic.

HOWARD (J.). **'Hooded' boom for Grape spraying.**—*Amer. Fruit Gr.*, lxi, 2, p. 13, 3 figs., 1941.

A specially constructed spray boom fitted with a hood to facilitate the application of black rot [*Guignardia bidwellii*] treatments in the eastern United States is briefly described. The contrivance has been found specially useful in the later stages of growth, when the drift from sprays directed upwards to the dense roof of foliage is apt to blow away from the rows, tending to leave some vines without complete coverage to act as 'pockets' of re-infection, besides causing discomfort to the operator. The hood confines the drift and breaks the wind, coverage being ensured by correct nozzle adjustment, pressure, and rate of travel through the vineyards.

**Service and regulatory announcements October–December, 1940. Plant quarantine import restrictions, Republic of Chile. List of current quarantine and other restrictive orders and miscellaneous regulations.**—*S.R.A., B.E.P.Q., U.S. Dep. Agric.*, 145, pp. 86–101, 1941.

A revised digest, dated 1939, of the plant quarantine import restrictions obtaining in the Republic of Chile from 1925 to 1938, is presented, and includes, *inter alia*, Decree No. 30 of 28th April, 1931, prohibiting the importation of potatoes from foreign sources as a means for the exclusion of wart disease (*Chrysophlyctis endobiotica*) [*Synchytrium endobioticum*], and a Decree [unnumbered] of 31st January, 1939, of which article 1 prohibits the sowing of wheat infected by loose smut (*Ustilago tritici*), and article 7 enacts that consignments of wheat imported for seed must be accompanied by a duly authenticated certificate vouching for the cultivation of the crop in localities free from the disease in question.

A summarized list is given of current domestic (continental United States, Hawaii, and Puerto Rico) and foreign orders and regulations.

**Service and regulatory announcements. List of intercepted plant pests, 1938–9.**—*S.R.A., B.E.P.Q., U.S.Dep. Agric.*, 53 pp., 1940.

Lists are given of pests and diseases intercepted on plants or plant products entering the United States during the period from 1st July, 1938, to 30th June, 1939. Among the phytopathological interceptions of economic importance are four of citrus canker (*Bacterium* [*Pseudomonas*] *citri*) found on limes from Java and the Straits Settlements, on grapefruit from India, and on an orange of unknown origin in baggage from Canada, one of white pine blister rust (*Cronartium ribicola*), three of citrus black spot (*Phoma citricarpa*), and 360 of Lima bean [*Phaseolus lunatus*] scab (*Elsinoe phaseoli*).

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# REVIEW
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LINN (M. B.). **The yellows disease of Lettuce and Endive.**—*Bull. Cornell agric. Exp. Sta.* 742, 33 pp., 13 figs., 3 graphs, 1940.

A full account is given of a comprehensive investigation carried out from 1935 to 1939 in the greenhouses and on the farms of 25 members of the Staten Island Growers' Association, New York, into lettuce and endive yellows caused by the aster [*Callistephus chinensis*] yellows virus and transmitted by the leafhopper *Macrosteles divisus* [*R.A.M.*, xx, p. 209]. The average loss from lettuce yellows in New York State from 1921 to 1938 has been estimated at 5 to 6 per cent. of the normal crop, with losses attaining 70 to 80 per cent. in some fields. The reduction in yield for the United States as a whole is probably not over 2 per cent., as there are important lettuce-growing areas as yet unaffected. No difference in susceptibility was noticed in 23 varieties and strains of lettuce tested, and curled-leaf and broad-leaf endive were also demonstrated to be susceptible.

On lettuce the disease is marked, before heading, by yellowing, blanching, and curling of the inner leaves, along the margins of which small brown spots are found. Slight vein-clearing is often present. If the plants become affected after heading, the heart leaves are twisted, dwarfed, and curled, the head failing to become firm. There is as a rule an abnormal production of lateral, upright shoots in the leaf axils, these lateral branches often bending down. The flowers on diseased branches are dwarfed and distorted, and give dwarfed, sterile seeds, if any. On broad-leaf endive (escarole) the symptoms are similar, except that the vein-clearing and the twisting of the inner leaves are less conspicuous. On curled-leaf endive the chief symptoms are leaf yellowing and stunting of the whole plant.

On Staten Island the virus overwinters principally on *Plantago major*, whence it is carried by the vector to lettuce and endive. The vector, it is thought, may overwinter in the adult stage in some locality far removed from cultivated areas. Studies on the dispersion of the vector into and from weeds adjacent to endive beds showed that it is driven into the weeds during cropping, but that later on it may pass back to endive or other beds. Wind direction may influence the direction of vector movement, but the leafhoppers do not move in perceptible numbers much over 200 ft. in four weeks.

Appreciable control was obtained as a result of the eradication of weeds within 100 ft. of prospective lettuce and endive beds by means of

sodium chlorate crystals or spray, at a cost of $33 to $36 per acre of weeds. The roguing of affected lettuces in small plantings did not give satisfactory control. Dusting at weekly intervals from transplantation to harvest with pyrethrum-sulphur dust containing at least 0·15 per cent. pyrethrins, or with 1 per cent. rotenone-sulphur dust significantly reduced infection, an increase of only 5 per cent. in marketable heads in most cases defraying the cost of dusting. When young lettuce plants were protected from leafhopper attack by being grown in cloth-covered frames or screened greenhouses, a considerable reduction in yellows resulted at harvest.

Longrée (Karla). **Wilt of Salsify, caused by Verticillium sp.**—*Phytopathology*, xxx, 11, pp. 981–983, 1 fig., 1940.

In 1939 a species of *Verticillium* producing both torulose hyphae and sclerotia was isolated from a brownish discoloration of salsify (*Tragopogon porrifolius*) roots collected at Ithaca, New York, by H. H. Whetzel. The simultaneous development of both torulose hyphae and sclerotia by the fungus is of interest in view of the use of the presence or absence of sclerotia as a means of differentiating *V. dahliae* from *V. albo-atrum* [*R.A.M.*, ix, p. 6 *et passim*]. The only previous record of salsify wilt due to *Verticillium* is by Jagger and Stewart, also from New York (*Phytopathology*, viii, pp. 15–19, 1918). Inoculation experiments involving the immersion of seedling roots in a mycelial and spore suspension of the pathogen under controlled greenhouse conditions at a mean temperature range of 72° to 78° F. gave positive results in 12 out of 25 plants, the foliage of which wilted and the vascular tissues assumed a reddish- to greyish-brown discoloration, the fungus being reisolated from the roots.

Swartwout (H. G.). **Spraying Grapes with special reference to black rot.**—*Circ. Mo. agric. Exp. Sta.* 211, 4 pp., 1941.

The following five-spray schedule is recommended for the control of vine black rot [*Guignardia bidwellii*] in Missouri, where it has likewise been found effective against anthracnose [*Elsinoe ampelina*]: (1) delayed dormant, when the buds have pushed out to a length of about ½ in., 12–12–100 Bordeaux mixture; (2) first summer, when the new shoots are 8 to 12 in. long, or as the flower buds separate, 8–8–100 plus 3 lb. lead arsenate for chewing insects; (3) second summer, just before or as the blossoms begin to open, same as (2); (4) as the flowering period closes, same as (2); (5) 10 to 14 days after (4), same as (2) but reducing the lead arsenate content to 2 lb. or replacing by calcium arsenate. Spraying, in conjunction with thorough vineyard sanitation, is cumulative in its effect, and cases are on record in which the incidence of infection fell from 25 to less than 1 per cent. after the first season of treatment under equally favourable weather conditions for *G. bidwellii*.

L. (C. A. D.) & Canal (F. P.). **Mildieu de la Vid.** [Vine mildew.]—*Rev. Fac. nac. Agron. Colombia*, iv, 10, pp. 1009–1036, 1 col. pl., 5 figs., 1941.

This is an account, based largely on the work of well-known European and American phytopathologists, of the history, distribution, sympto-

matology, life-history, mode of infection and dependence on environmental conditions, and control of vine downy mildew (*Plasmopara viticola*), which is stated to be prevalent in all the viticultural regions of Colombia.

FAES (H.) & STAEHELIN (M.). **De l'action accélératrice des bouillies cupriques sur l'evaporation de la pluie, du brouillard ou de la rosée mouillant les feuilles de la Vigne.** [Of the acceleratory action of copper mixtures on the evaporation of rain, mist, or dew moistening Vine leaves.]—Reprinted from *Chron. vitic., 1940*, 8 pp., 1940.

Previous literature relating to the acceleration by copper-containing compounds of the evaporation of moisture from natural sources on vine leaves, considered as an indispensable adjunct to their fungicidal properties in connexion with downy mildew [*Plasmopara viticola*] control, is summarized, and a tabulated account is given of the writers' laboratory and field experiments in 1940 at the Swiss Federal Viticultural Station, Lausanne, to determine the relative value in this respect of some standard mixtures. It was found that adult vine leaves sprayed with Cadoret's 'blue' (alkaline) Bordeaux mixture (3 per cent. each of copper sulphate and lime) [*R.A.M.*, vii, p. 614] were dried after being wetted by rain in 1 hour 46 minutes, the corresponding periods for ordinary Bordeaux (2 per cent.), 1 per cent. cuprenox (copper oxychloride), and the untreated controls being 2 hours 6 minutes, 3 hours 9 minutes, and 3 hours 41 minutes, respectively. The consensus of opinion as regards the time required by *P. viticola* to induce effective infection of the foliage is that a minimum of 1½ to 3 hours is necessary, hence in a great number of attacks the 'blue' mixture would inhibit the process. Notwithstanding the promising outlook for the use of this economical and effective treatment in Swiss vineyards, the writers strongly advise caution in the introduction of any essential modifications in the present spraying schedule. Small-scale experiments should be conducted in 1941 with a weak Bordeaux mixture (1 per cent. each of copper sulphate and lime) before proceeding further in the matter.

**Fourteenth Annual Report of the Commonwealth Council for Scientific and Industrial Research for the year ended 30th June, 1940.**—102 pp., 1940. [Received June, 1941.]

This report [cf. *R.A.M.*, xix, p. 457] contains, *inter alia*, the following items of interest. When wheat was grown in 5 gal. soil-containers, in two seasons symptoms of whiteheads developed on plants in soil uncontaminated with fungi. As in other experiments in Australia and elsewhere, whiteheads have not been produced experimentally by soil contamination with *Ophiobolus graminis* and other organisms reputedly associated with the condition in the field, it is tentatively concluded that whiteheads are an expression of physiological trouble associated with the chemical composition of the soil [ibid., xix, p. 457].

In experiments on the control of downy mildew [*Peronospora tabacina*: ibid., xix, p. 733] in tobacco seed beds, by means of benzol, solvesso compounds, and para-dichlorbenzene, the best results were given by the first-named, but solvesso I was very promising. The third

material failed to prevent the spread of infection, possibly owing to the low temperatures prevailing.

The most important of the less well-known virus diseases of the potato in Australia is one which is probably related to or identical with the American 'spindle tuber' [ibid., xx, p. 221]. Preliminary field surveys indicate that the chief insect vector of potato virus diseases in Australia is *Myzus persicae*. Greenhouse transmission tests demonstrated its ability to act as a vector of viruses A, Y, and leaf roll. Two types of potato wilts occur in the tableland areas of New South Wales, one associated with *Verticillium albo-atrum*, and found in the cooler areas, the other associated with a species of *Fusarium*, probably *F. oxysporum*, and present in the hotter areas. In Australia, *V. albo-atrum* spreads by root contact from plant to plant through the soil.

In most instances, pine trees treated individually or in small groups with boron compounds showed signs of recovery from needle fusion [ibid., xx, p. 40] during the first season after treatment, but reverted during the next season, unless the treatment was repeated. Trees similarly treated with superphosphate in most cases did not respond until the second season after treatment, but their recovery appeared to be more lasting. Inoculation tests indicated that while *Diplodia pinea* [loc. cit.] readily produces die-back of laterals and leaders on vigorous pine trees, the infections generally remain localized unless the tree has been weakened by unfavourable environmental conditions.

The incidence of internal cork of apples [ibid., xix, pp. 603, 659] was low in Tasmania in 1939, the effect of soil dressings of $\frac{1}{2}$ to 2 lb. of borax per tree having persisted for four years. Storage wastage was increased in Granny Smith, Delicious, and Democrat apples by a soil dressing of boron (4 lb. per tree) and 1 per cent. spray, but was not affected by a 1 lb. soil dressing or 0·25 per cent. spray. Soft scald in Jonathan apples can be controlled by storage at 36° F. until the end of April, 34° during May, and 32° subsequently. Serious outbreaks of Jonathan spot can be controlled by an atmosphere containing 5 per cent. carbon dioxide. Bitter pit [ibid., xix, p. 156] in immature Granny Smith apples was again controlled by pre-treatment with ethylene. Confirmation was also obtained that bitter pit in Granny Smith apples can be almost entirely controlled by picking the fruit when it is sufficiently mature and storing it at once at 32° to 34°. Bitter pit was much less in apples picked at the end of April than it was in those picked in the beginning of the month. Even in the more mature apples, however, considerable bitter pit developed if the fruit was left at outside temperatures for several days before being stored. When stored at once, the more mature apples remained almost unaffected until October. In cool storage tests with apples promising results were obtained by using a proprietary wax emulsion incorporated in wraps or as a dip, which retarded the rate of colour change, and reduced pit, Jonathan spot, and shrivelling.

Several years' experiments have afforded strong evidence that a storage temperature of 42° is generally the most satisfactory for the avoidance of excessive mould development [chiefly *Penicillium digitatum* and *P. italicum*: ibid., xix, p. 458] and storage spot [loc. cit.] on Victoria-grown Washington Navel and Valencia oranges. Careful

handling and the avoidance of late picking (after mid-July for Washington Navels) are also important factors. Investigation into wilting of oranges due to loss of water, which sometimes causes a considerable loss in the market value of the fruit, showed that wilting becomes apparent when the water loss exceeds about 5 per cent. of the initial weight. Most of the detergent and fungicidal solutions used for treating the fruit in the packing-houses cause heavy increases in the rate of evaporation of water from the fruit; in some cases this increase exceeds 100 per cent. Thorough rinsing with clean water greatly reduces the adverse effect of the detergent solutions when the oranges are carefully washed by hand, and the effect of rinsing in machine handling is now being studied. Evidence was obtained that one of the long-chain sulphonate detergents used commercially in Australia is an efficient cleanser, without appreciable effect on the rate of loss of water from oranges when it is used for washing by hand; when, however, it is used in one type of commercial machine, there is some increase in the rate of evaporation. The practice of coating oranges with wax after washing was found to reduce the rate of loss of water by about 40 per cent.

**Plant diseases. Notes contributed by the Biological Branch.**—*Agric. Gaz. N.S.W.*, lii, 3, pp. 159–163, 1941.

In 1940, unsprayed citrus trees at Leeton, New South Wales, developed a moderate amount of *Septoria* spot [*S.* (?) *citricola*: *R.A.M.*, xix, p. 388] though the sprayed series was scarcely affected. Bordeaux mixture (2–4–80½) appeared to give as effective control as one at 4–4–80½, while combined zinc and copper sprays also gave good results.

Most of the Imperial lettuce varieties grown in New South Wales have been bred in California by crossing the New York lettuce with European varieties. When first released, Imperial D, Imperial F, Imperial 615, and Imperial 847 were resistant to downy mildew (*Bremia lactucae*) [ibid., xix, p. 577], but all, owing to the appearance of a fifth strain of the fungus in California, became susceptible. This strain now appears to be present in Australia, since the disease commonly occurs on Imperial lettuces in New South Wales.

New records for New South Wales made in January, 1941, include brown rot of grapes (*Sclerotinia fructicola*) and strawberry leaf blight (*Dendrophoma obscurans*) [ibid., xviii, p. 402], both in the Sydney metropolitan area.

**Plant diseases. Notes contributed by the Biological Branch.**—*Agric. Gaz. N.S.W.*, lii, 4, pp. 210–213, 217, 3 figs., 1941.

The most serious disease of maize in New South Wales is root and basal stalk rot due to *Gibberella saubinetii* [cf. *R.A.M.*, xix, pp. 642, 699]. Field surveys have shown that in individual fields 25 to 30 per cent. of the plants may be infected, while in many instances, especially on old maize land, infections of up to 70 per cent. have been found. The control measures recommended consist in burning all the old stalks and plant debris left after harvest, crop rotation, and seed selection.

Bitter rot of apples (*Glomerella cingulata*) [ibid., xviii, p. 235] is destructive to fruit at all stages, and may cause trouble in storage [ibid., xviii, p. 784]. During the past summer and autumn, owing to

warm, humid, showery weather, infection was more noticeable and widespread in New South Wales than for several seasons previously. To control the disease all mummified and infected fruits should be burnt, the diseased twigs and badly cankered branches removed, the cankers scraped, and the wounds painted with $1\frac{1}{2}$ lb. copper sulphate and 1 lb. lime per 2 gals. water. All pome fruits should be sprayed with Bordeaux mixture ($1\frac{1}{2}$–1–80) plus $\frac{1}{2}$ gal. white oil when approaching maturity.

New records for New South Wales in February 1941 include browning and stem break of flax and linseed (*Linum usitatissimum*) due to *Polyspora lini*.

WATERS (H. B.). **Report on the Department of Agriculture, Gold Coast, for the year 1939–40.**—6 pp., 1940.

During the period under review cacao swollen shoot [*R.A.M.*, xix, p. 521] made its appearance in the Manya Krobo area, near Bisa, Gold Coast, at Tafo in the experimental plots, and also spread considerably in the area originally affected. The planting of shade and shelter trees was extended, and in the New Juaben-Akim Abuakwa area 13,000 acres were planted with 250,000 seedlings, while at the end of the year nurseries capable of supplying over 600,000 seedlings for planting in 1940 were established. Steps are being taken to survey the areas surrounding the original region of infection in the Eastern Province in order to prevent spread to Ashanti and the Central Province. Further evidence that the disease is of virus origin is provided by its spread and range under different conditions of shade, soil, and rainfall. A type of 'swollen shoot' in the Huhunya and Bisa areas associated with little or no die-back is being investigated to determine whether it is due to a mild strain of the virus or to environmental factors.

The banana Panama disease [*Fusarium oxysporum cubense*] situation is now under control. Cases discovered and treated dropped from 299 in the first, to 42 in the last, quarter of the year, all being found in the Western Province; the disease has not so far been reported from the Central Province. A banana disease resembling Wardlaw's 'water soak' occurred in the Eastern Province.

**Annual Report on the Department of Agriculture, Zanzibar Protectorate, 1940.**—9 pp., 1941.

In Part I of A. H. Campbell's report on his investigations of sudden death of cloves in Zanzibar [*R.A.M.*, xviii, p. 615] the conclusion is reached that this disease is identical with apoplexy in Madagascar [ibid., xviii, p. 548], both being of a purely functional (non-parasitic) character. The following factors are operative in the etiology of sudden death: (*a*) drought and inundation, (*b*) exceptionally heavy cropping, (*c*) root mutilation through irregular cultivation and damage to branches from the picking of heavy crops, and (*d*) the effect of opening the canopy on the water balance of the tree and on soil conditions. All these factors are thought to be concerned in the development of epidemics of the disease, but the last-named plays no part in sporadic outbreaks. In old plantations, epidemics of sudden death are prevalent, owing to accentuation of factors (*a*), (*b*), and (*c*), and the breaking of

the canopy in an over-mature stand, already on the verge of extreme water strain. As a result of the canopy break an area of soil partially occupied by the roots of adjoining trees is exposed to the full drying power of the sun, humus is destroyed, the evaporation from the exposed soil is increased, and the rise in temperature of the soil may be expected to exert an adverse effect on the absorbing capacity of roots of the superficial root plate, or even to kill them. At the same time, the leaf surfaces of the trees round the margins of the break are more fully exposed than before, resulting in increased transpiration and diminished water absorption, with consequent extensive wilting and death. No economical method of preventing sudden death being practicable, the problem resolves itself into one of regeneration.

**Botany and plant pathology section.**—*Rep. Ia agric. Exp. Sta., 1939–40,* Part I, pp. 132–151, 5 figs., 1940.

This report on plant disease work in Iowa in 1939–40 [*R.A.M.*, xix, p. 326] contains, *inter alia*, the following items of interest. Further studies by S. G. Younkin and I. E. Melhus on damping-off of watermelons [loc. cit.] showed that in the first six weeks after planting 65 per cent. of the seedlings died. Loss was greatest while the seeds were germinating, at which time the soil temperature was well under 70° F., and Pythiaceous fungi were isolated from most of the affected seedlings. After 12th May, the mean soil temperature was over 70° and losses declined; *Rhizoctonia* and *Fusarium* spp. only were isolated from these seedlings. The evidence suggested that *Pythium irregulare* was the primary cause of losses before 12th May. The *Pythium* was observed to be destructive only in cool soils and experimental evidence indicated that high soil temperatures do not eliminate the fungus from the soil but in some manner reduce seedling injury.

H. C. Murphy states that the new oat varieties Boone, Marion, and Hancock, first distributed to Iowa farmers for growing in 1940, are resistant to the endemic races of loose and covered smut [*Ustilago avenae* and *U. kolleri*: ibid., xix, p. 327] and to races 1, 2, and 5 (but not 8) of stem rust [*Puccinia graminis avenae*]. Boone seems to be adequately resistant to all 54 races of crown rust [*P. coronata*: loc. cit.] known in North America, except the relatively rare ones 41, 50, 52, and 53. Numerous homozygous, high-yielding, crown rust-, stem rust-, and smut-resistant selections possessing resistance to race 8 of stem rust are under test. *Avena brevis*, C.I. 3436, recently introduced from Brazil, was resistant to stem rust, including race 8, and also to crown rust, under field conditions in 1939. Before 1938, races 1 and 7 of crown rust had been the most prevalent and widely distributed races since 1927, but in both 1938 and 1939 races 1 and 6 were by far the most dominant.

A survey in the spring of 1940 of sweet potato hot-beds showed the presence of cortical lesions on the older roots and stems when the slips reached a height of about 6 in. Other lesions were present at the end near the root tips. In isolation tests from plants gathered on 1st June stem lesions gave *R.* [*Corticium*] *solani*, *Fusarium* spp., and *Penicillium* spp., while those near or at the root tip gave species of *Pythium*,

*Fusarium*, and *Trichoderma*. It is evident that parasites are borne from the hot-bed to the field in the slips.

G. C. Kent and I. E. Melhus state that strains of apple blight (*Bacillus amylovorus*) [*Erwinia amylovora*] uniformly required complex forms of nitrogen to survive in culture. Comparative tests showed that *B. tracheiphilus* [*E. tracheiphila*] and *B. salicis* [*Bacterium salicis*: ibid., xx, p. 94] behaved similarly, while the *B. carotovorus* [*E. carotovora*] group were all capable of utilizing inorganic nitrogen in the form of nitrates or ammonium salts as well as simple amino or amide forms after five successive transfers at 48-hour intervals on the synthetic medium.

I. E. Melhus, J. N. Martin, C. S. Reddy, W. F. Buchholtz, and H. C. Murphy state that *Pythium de Baryanum* [ibid., xix, p. 328] caused a serious root rot of oats at 20° C. and below, infection being particularly serious between 10° and 15°. Swedish Select oats grown to maturity in infected soil averaged 36·3 seeds per plant, as compared with 81·7 for plants grown in steamed, uninfected soil. The latter plants were, on an average, 10 in. taller than the former, tillered one to two weeks earlier, and at maturity gave approximately twice as much dry weight of roots and tops.

Owing to dry weather in May *Pythium* root disease of maize [loc. cit.] did not appear to be serious in Iowa in 1939 except in certain localities where soil moisture favoured infection. Isolations at Ames and Kanawha from root lesions of seedlings from early plantings gave *Pythium* cultures to the extent of only 1 to 2 per cent. Root isolations from later plantings made early in June and showing leaf yellowing and dwarfing gave 18 and 12 per cent. *Pythium* at Ames and Kanawha, respectively. Other fungi found among the isolates were *R.* [*Corticium*] *solani*, *Gibberella saubinetii*, *Helminthosporium sativum*, and *Fusarium* sp. In all, 87 *Pythium* isolates were found, of which four were *P. de Baryanum* and the remainder *P. graminicola*.

I. E. Melhus, C. S. Reddy, W. F. Buchholtz, and E. L. Waldee state that tip rot of sugar beets (*Aphanomyces cochlioides*) [loc. cit.] was reported to be severe only in three fields, and in all three sugar beets had been planted more frequently than once in four years. A field showing severe infection in 1932 was again planted to sugar beets in 1939; it showed no tip rot, though an adjacent plot, planted to sugar beets at intervals in the same period, was severely infected. *Amaranthus retroflexus* and *Chenopodium album*, two common weeds in northern Iowa, proved to be as susceptible as sugar beet. In laboratory plantings of sugar beets in field soil infested with *A. cochlioides* and *P. de Baryanum*, infection by the latter was confined to germinating seed and young seedlings, and was partly controlled by seed treatment, whereas infection by the former did not occur on germinating seed, but completed the destruction of seedling stands from both treated and untreated seed.

Of six commercial sugar beet varieties tested in the field, U.S. 200×215, and American Nos. 1936 and 5 were least susceptible to *Cercospora* leaf spot (*C.* [*beticola*: ibid., xix, pp. 327, 687]).

I. E. Melhus states that blight due to *Phomopsis juniperovora* [ibid., xix, pp. 179, 444] makes it almost impossible to grow red cedar [*Juni-*

*perus virginiana*] nursery stock in Iowa. Leaf spot diseases of green and white ash due to species of *Cylindrosporium* and cherry shot hole (*Coccomyces hiemalis*) continue to prevail on nursery stock. After inflicting heavy damage in recent years, these two diseases are now satisfactorily controlled by means of Bordeaux mixture (3–4–50) or 2 per cent. lime-sulphur.

**Research aids Utah agriculture. Biennial report 1938–1940.**—*Bull. Utah agric. Exp. Sta.* 294, 119 pp., 54 figs., 2 graphs, 1 map, 1940.

In this report on plant disease work in Utah from 1938 to 1940 [cf. *R.A.M.*, xiv, p. 681], it is stated that a new selection of spring wheats from the Federation × Hope cross is highly resistant to all races of bunt [*Tilletia caries* and *T. foetida*], loose smut [*Ustilago tritici*], and rust [*Puccinia* spp.], and is being tested by a few farmers in the spring of 1941. Among the strains of wheat resistant to smut developed at Logan, the pure line Turkey 926, tested at Nephi under dry land conditions, proved superior and is now being distributed to farmers.

In field inoculations of approximately 130,000 lucerne seedlings with the bacterial wilt organism, *Phytomonas* [*Aplanobacter*] *insidiosum* [ibid., xix, p. 709], resistance was found in all varieties and strains employed: in Utah Pioneer from 12 to 20 and in Turkestan No. 96696 from 40 to 50 per cent. Isolations from lucerne stems exhibiting symptoms of stem blight or black stem yielded two organisms: *Pseudomonas* [*Bacterium*] *medicaginis*, which is believed to be the primary cause of the disease, and an *Ascochyta* sp., probably a secondary invader.

*Verticillium* wilt (*V. albo-atrum*) [ibid., xv, p. 519] is stated to be the most prevalent and serious disease of the tomato in Utah. No commercial variety could be found with more than a moderate degree of resistance, but two red-fruited wild tomatoes from southern Peru, *Lycopersicum esculentum* var. *cerasiforme* and *L. pimpinellifolium*, exhibited a degree of resistance closely approaching immunity, and one green-fruited species from central Peru, *L. glandulosum*, appeared to be practically immune from the disease. Hybrids from commercial tomato and the *cerasiforme* variety, which were readily obtained, exhibited fair fruit size and high resistance to the disease in the third generation and are being back-crossed to commercial tomato to increase size and quality. *L. pimpinellifolium* and the green-fruited species have been only recently included in the breeding programme.

Seed treatment trials showed that the extraction of tomato seed by fermenting the highly macerated fruit pulp containing the seed for 96 hours, or a seed soak in 0·9 to 1 per cent. acetic acid for 24 hours before the seed has been dried following extraction, to be the most effective treatments for the control of bacterial canker (*Aplanobacter michiganense*) [ibid., xviii, p. 765]. Survey data indicate that infested seed-beds are the most serious single source of bacterial canker infection. The complete destruction of the infested bed and the erection of a new one with new, clean soil situated far enough from the old site are recommended. Before being used again, old bed frames and sash covers should be thoroughly washed in a 3 per cent. formaldehyde solution and canvas and cloth covers laundered. Longevity studies

showed that *A. michiganense* will remain viable in air-dried plant tissue for over five years.

None of the strains or varieties of commercial tomatoes tested for resistance to the curly top virus (western yellow blight) [ibid., xiv, p. 339] in trial plots situated in the midst of a large insect-breeding area proved sufficiently resistant to the disease. Selections of a Mexican wild tomato, Ojo de Venado, were highly resistant to both the virus and drought, and a dwarf selection of the novelty tomato Red Peach was fairly so. Some of the green-fruited types of tomato introduced from South America in 1937–8 seemed to be more highly resistant to the curly top virus than the red-fruited wild or novelty types of *L. esculentum*, e.g., strains of *L. glandulosum* and *L. peruvianum* vars. *humifusum* and *dentatum*. Repeated attempts to cross the green-fruited types with commercial tomatoes failed, but crossing *L. hirsutum* with the resistant green-fruited types met with some promise of success. Through a series of re-combinations of hybrids it is hoped to unite the resistant qualities of the green-fruited types with the commercial advantages of *L. esculentum*. Direct seeding by means of the drill method reduced curly top infection from 6·5 per cent. in the control to slightly over 1 per cent. and increased the yield by 1½ tons. Early planting proved more advantageous than midsummer or late planting: tomatoes planted about 20th April showed only 5 per cent. curly top infection as against 20 per cent. in those planted in May. The highest yields and the best disease control were obtained with densely planted plots.

Survey results show that western celery mosaic [ibid., xix, p. 693] has become generally established in Salt Lake county, where it is estimated that 75 per cent. of the celery fields were affected during 1939, sometimes to a degree of approximately 100 per cent. infection. In heavily infested fields the yield was decreased by 50 per cent. A member of the carrot family was found generally distributed in the mosaic-infested areas and is suspected of harbouring the virus.

Cherry leaf mottle [ibid., xv, p. 664] has been found generally distributed in orchards, affecting from about 1 to 26 per cent. of the trees. The disease attacks both leaves and fruits and decreases the yield and quality of the fruit. No definite proof of transmission has as yet been obtained, but pending further research results, it is recommended to remove severely diseased trees.

The suspected 'X' disease or yellow-red virosis [ibid., xx, pp. 213, 310] is stated to have spread from a few limited chokecherry [*Prunus virginiana*] areas to adjacent peach orchards of Box Elder, Weber, and Davis counties, where the average incidence of infection was 23·2 per cent. of trees, but some orchards showed over 40, 50, and up to 68 per cent. infection. The disease is apparently becoming a major problem in peach production and it is expected that control will prove difficult and costly.

**Fiftieth Annual Report for the fiscal year ended 30th June, 1940.**— *Bull. Wash. St. agric. Exp. Sta.* 394, 124 pp., 1940. [Received May, 1941.]

The section of this report dealing with plant pathology (pp. 70–78) [cf. *R.A.M.*, xviii, p. 440] contains the following items of interest, apart

from those already noticed from other sources. In work by C. S. Holton, F. D. Heald, and E. F. Gaines three additional races of *Tilletia tritici* [*T. caries*] and two of *T. levis* [*T. foetida*] were identified, bringing the total of the former to 14 and of the latter to 10. It was ascertained that race and species hybrids of *Tilletia* may give rise to some races equal in virulence to one parent or the other, some less virulent than either parent, some which possess the combined virulence of both, and some with a degree of virulence not shown by either. Segregation of factors for smooth and reticulate spores was observed in species hybrids. Oro × Tenmarq was found to be highly resistant to all races except L 8; the Oro race and Utah selection 122 A–70–3 were highly resistant to all races tested, while the spring wheat variety Flomar was susceptible to all the races used, except the Hohenheim races T 9, 10, and 12.

The same workers ascertained that five new C.I. oat varieties Bannock, Merion, Hancock, Boone, and Fulton were highly resistant to 40 races and collections of *Ustilago avenae* and *U. levis* [*U. kolleri*] [ibid., xix, pp. 271, 526]; only one collection infected Boone (1 per cent.) and only one infected Merion (3 per cent.). Seven races of buff smut resulted from mutation and hybridization. Factors for powdery and indurate types of sori in *U. avenae* segregated and recombined on a 3 : 1 ratio basis, the powdery factor being dominant.

Limited tests by F. D. Heald and J. D. Menzies indicated that the larger part of the surface of washed apples is, under normal conditions, almost free from *Penicillium expansum* [ibid., xix, p. 712] spores. The spore load of the fruit is chiefly confined to the calyx and within the calyx canal. Inoculation of open lenticels during ordinary handling is uncommon. The amount of inoculum may, perhaps, be a more important factor in lenticel infection than susceptibility of the lenticels. Of various methods of inoculating lenticels, dusting the spores over the surface of the apple with a dry cotton swab was the most satisfactory.

In further studies of 615 isolations from rotting pears H. English and F. D. Heald obtained 75 distinct species or strains of fungi belonging to 22 genera. Twenty-two species in 15 genera are recorded for the first time as causing pear rot in North America, and of these, *Hormodendron pyri*, *Mucor pyri*, and *Aspergillus pyri* are considered to be new species [but are not described]. To *Penicillium* belonged over half the fungi isolated, *P. expansum* being the commonest. Grey mould, due to various strains of the *Botrytis cinerea* complex was the next most frequent. At room temperature, the most rapid decay was caused by *Rhizopus nigricans*. Inoculations with a spore suspension of *P. expansum* on Bartlett pears gave numerous lenticel infections at room temperature, but at cold storage temperature no infection developed. Anjou pears were successfully infected through the lenticels with spore suspensions of 11 out of 17 isolates at room temperature, but in cold storage by only six. High humidity increased the number of lenticel infections at room temperature, but gave little increase in cold storage.

Of eight distinct physiologic races of *Ustilago bullata* [ibid., xx, p. 121] found by G. W. Fischer, race 1 is common in the Pacific Northwest on *Agropyron pauciflorum*, *Hordeum jubatum*, and *H. nodosum*, though the known host range comprises the genera *Elymus* and *Sitanion*.

Races 5 and 7 are common on mountain brome grass [*Bromus*] and related species in the west, and infect also other *Bromus* spp., *Elymus canadensis*, *E. sibiricus*, and *Hordeum nodosum*. Tests demonstrated that concentrations of 0·65 to 10 gm. of smut spores per l. of water in the inoculum greatly reduced the stand of inoculated plants without increasing the percentage of infection; concentrations of 0·003 gm. per l. gave comparatively high percentages of infection. Cultures of 40 collections of *U. bullata* on agar media showed it to be a composite species consisting of a number of broadly different cultural types, which also differed pathogenically. Two cultures of the same parentage but of opposite sex frequently differed so widely in cultural characters as to seem completely unrelated. *U. bullata* was hybridized with *U. nigra*, *U. hordei*, and *U. striaeformis* and $F_1$ spores obtained. Ceresan and new improved ceresan were effective against *U. bullata* in preliminary tests.

Greenhouse inoculations of species of *Agropyron*, *Elymus*, *Hordeum*, *Lolium*, and *Sitanion* with 25 collections of *U. hordei* gave positive results on *A. caninum*, *E. sibiricus*, *E. glaucus*, *H. jubatum* var. *caespitosum*, *H. nodosum*, and *S. hystrix*. No noticeable differences were seen in the comparative virulence of the collections, many of which were definite races of *U. hordei*.

Inoculations of *Agropyron* and *Elymus* spp. with *T. caries* and *T. foetida* resulted in the infection of certain species of *Agropyron* and *E. glaucus*, the latter being a new host for wheat bunt.

L. Campbell states that in field tests made at planting time formaldehyde dust, calcium cyanamide, new improved ceresan, and hydrated lime at the rate of 150, 135, 6, and 700 lb. per acre, respectively, each with commercial fertilizer mixed by hand into the soil to a depth of 1½ to 2 in. in strips 3 to 4 in. wide significantly reduced black root [*Phoma betae*: ibid., xix, p. 132] and gave an important increase in the number of healthy plants.

Investigations by L. Campbell and C. D. Schwartze indicated that running-out of strawberries is due to yellows [xanthosis: ibid., xix, p. 107] and crinkle [ibid., xix, p. 645], and to root rots (black root). Yellows in serious proportions is most prevalent throughout Pierce County, where it commonly so reduces the longevity of the plantings that only one profitable crop can be gathered. Crinkle is more widely distributed, but less destructive. Root rot may be found in nearly all commercial fields, and is found in the Western Washington Experiment Station plots where it seriously interferes with strawberry-breeding work. Red stele (*Phytophthora* sp.) [ibid., xix, pp. 550, 608] occurs on heavy, poorly drained sites, but is not likely to prove of importance.

L. K. Jones states that as all commercial carnation stocks appear to be infected with the yellows virus, attempts have been made to develop virus-free seedlings for use in further investigations on the nature of the disease. Seedlings from 69 crosses have been studied, and four promising new varieties have been propagated to 9 to 12 plants each. The virus was shown to be transmitted from affected plants to healthy seedlings by aphids [unspecified], grafting, and mechanical inoculation. When Patrician plants were grown in neutral peat to which nutrient solutions were added, low nitrogen, phosphorus,

or potash availability aggravated the severity of the symptoms, as compared with high availability of all nutrients. Fifty-seven commercial varieties showed marked differences in susceptibility, the following showing the least injury: Admiration, Carlotta, Dairy Maid, Joan Marie, Mrs. Sims, Pink Abundance, Rosalie, and Vivian.

**Department of Plant Pathology.**—*Rep. agric. Res. West. Wash. Exp. Sta., 1939–40*, pp. 37–42, 1940.

Transmission studies carried out by G. A. Huber and K. Baur are reported on a number of red raspberry seedlings selected in co-operation with the Department of Horticulture as resistant or partially resistant to *Amphorophora rubi*, the aphid vector of red raspberry mosaic [*R.A.M.*, xx, p. 69]. The results show that no plants from these selected seedlings became infected with mosaic when viruliferous aphids were placed on the plants without bagging, but infection occurred following inoculation by bark grafting. In most cases, aphid-resistant seedlings resulting from a cross between aphid-resistant and aphid-susceptible parents showed mosaic symptoms similar to those on the aphid-resistant parent, while aphid-susceptible seedlings showed symptoms similar to those on the aphid-susceptible parent. When bark grafts from black raspberry [*Rubus occidentalis*] plants infected with mosaic were made to the red raspberry varieties Lloyd George and Cuthbert, no mosaic symptoms appeared, but when bark grafts were made from the inoculated red varieties to the Cumberland black raspberry, 90 per cent. of the plants showed the typical black raspberry mosaic symptoms. Several black raspberry seedlings grown from seed of apparently mosaic-free plants showed definite ability to escape infection by resistance either to the vector or the virus.

A number of young Lloyd George red raspberry plants showed a disorder characterized by somewhat stunted canes with the terminal leaves forming a rosette, the leaves being generally wrinkled with the tips curled down and remaining close to the canes. The disease was transmitted by bark grafts to healthy Lloyd George plants, but failed to infect Cuthberts or Cumberlands.

Further studies by the same workers on the brown rot of stone fruits in Western Washington [ibid., xx, p. 24] revealed that two species, *Sclerotinia fructicola* and *S. laxa*, are responsible for the disease. Inoculations showed that both species caused blossom blight on apricot, cherry, and peach, but not on Italian prune; only *S. laxa* caused twig blight on apricot, cherry, and peach; and both species caused fruit decay of apricot, cherry, peach, and Italian prune. Apothecia were produced only by *S. fructicola* and were found only on Italian prune mummies overwintering on the ground. Trials conducted in prune orchards in Clark county during the springs of 1939 and 1940, showed that commercial pulverized and oiled calcium cyanamide, applied at the rate of 200 to 300 lb. per acre to the surface of the soil and vegetative cover just before the opening of the first blossoms, prevented the development of the apothecia of *S. fructicola.* Material applied on 13th March during rainy weather failed to remain toxic during the period of apothecial development, whereas later applications retained their toxicity throughout this period. In dusting experiments against

fruit decay, kolodust afforded better protection than other sulphurs tested; ground and sublimed sulphurs caused a reduction in fruit size, whereas hydrated lime conferred excellent protection on the fruit and caused no reduction in size.

A survey by K. Baur and G. A. Huber showed that boron deficiency occurs in a large part of the 15,000 acres of lucerne in Western Washington [ibid., xvii, p. 344], on 13 different soil types. In pot culture and field trials the deficiency was corrected by additions, either in spring or in autumn, of 50 to 60 lb. of borax per acre to silt and clay loam soils and 30 to 40 lb. to the lighter soils.

**Plant pathology.**—*Rep. Hawaii agric. Exp. Sta., 1940,* pp. 67–74, 5 figs., 1941.

In this report on plant disease work in Hawaii in 1940 [cf. *R.A.M.*, xix, p. 460] it is stated that the papaw virus disease reported in 1939 [ibid., xviii, p. 693] did not recur, but was kept alive in the greenhouse by artificial inoculation. The virus appeared to tolerate at least one hour in solution and a 1 in 20 dilution, and was transmitted from and to papaw by inarch grafting.

Control of papaw anthracnose (*Colletotrichum gloeosporioides*) [ibid., xix, p. 664] was obtained by spraying the fruits at 14-day intervals, beginning in November, with Bordeaux mixture (4–4–50), cuprocide 54, or cuprocide 54 Y. The fruits sprayed with Bordeaux mixture, however, became so russeted as to be unsaleable, while the foliage of these trees was also injured. Nearly all the fruits on the unsprayed trees were valueless owing to severe infection.

*Phytophthora parasitica* was observed in one district causing appreciable destruction of papaw fruits and killing the top third of some 50 per cent. of the plants in a four-acre planting. The affected fruits dehisced prematurely and mummified. Inoculation experiments demonstrated that the fungus is a virulent wound parasite of the stems and a weak wound parasite of the roots of papaw. Trees of all ages were found to be attacked.

Napier or elephant grass (*Pennisetum purpureum*) throughout the Territory was infected by a species of *Helminthosporium* which killed the leaves and stems. Heavily attacked plantings were almost useless as forage. The condition occurred at all elevations from sea-level up to a height of 2,500 ft. and appeared to be more or less unaffected by differences in rainfall.

Studies on the use of semesan and cuprous oxide (red copper oxide) against damping-off of various crops caused mainly by species of *Pythium* and *Rhizoctonia* showed that semesan should be employed for cauliflower, kale, turnip, cucumber, squash, okra [*Hibiscus esculentus*], lucerne, and pea, while either semesan or red copper oxide can be used on Swiss chard [*Beta vulgaris* var. *cicla*].

Other diseases noted during the year included powdery mildew of papaw, due to *Oidium caricae* [ibid., xviii, p. 506].

Smith (C. O.). **Olive knot induced on species of the Oleaceae by artificial inoculations.**—*Phytopathology*, xxxi, 4, pp. 361–362, 1 fig., 1941.

Positive results were obtained at the California Citrus Experiment

Station in inoculation experiments with pure cultures of *Phytomonas* [*Pseudomonas*] *savastanoi* [*R.A.M.*, xviii, p. 825] on olive, *Olea capensis*, *O. verrucosa*, *O. ferruginea*, *O. laurifolia*, *Forestiera neomexicana*, *Osmanthus americanus*, and *O. aquifolium*. *Phillyrea decora* developed abnormal overgrowths but not the typical knots produced on the other Oleaceae included in the trials. No infection developed on *Ligustrum* and *Syringa* spp.

STEENBJERG (F.). **Das Kupfer im Boden mit besonderer Bezugnahme auf die Heidemoorkrankheit.** [Copper in the soil with special reference to the reclamation disease.]—*Tidsskr. Planteavl*, xlv, pp. 259–368, 1940. [Danish. Abs. in *Chem. Zbl.*, cxii (i), 13, p. 1724, 1941.]

As a result of five years' study of the relevant literature and personal observations, the writer concludes that copper is an indispensable plant nutrient, the absence of which is the cause of reclamation disease [*R.A.M.*, xviii, p. 668; xx, p. 297], expressed by chlorosis of the leaf tips of oats, barley, and other cultivated plants. Soil analyses showed that the available copper is at a minimum at a $P_H$ between 5·5 and 6·5. The copper content of the various crops was found to range from 2 to 10 mg. per kg. dry weight, reaching a maximum in leafy plants and falling to a minimum in mangolds and cereals. The influence of the preceding crop on the availability of copper is very variable, that of meadow being the most propitious for this as for other 'trace' elements. Different crops have varying copper requirements, and one making excessive demands on this mineral should never immediately follow another of similar constitution. Desiccation of the soil reduces the amount of copper available to the plants, whereas steam sterilization enhances it. Copper deficiency can be remedied by the application to the soil of coke ash (which likewise exerts a beneficial effect on other 'trace' element deficiencies), compost, stable manure, copper sulphides, finely ground metallic copper, and clarified sludge containing a low percentage of copper [ibid., xviii, p. 667], but further field experiments are necessary for the final solution of this aspect of the problem.

NIESCHLAG (F.) & WESTERHOFF (H.). **Eine kupferhaltige Schlacke als Ersatz für Kupfersulfat in der Bekämpfung der Heidemoorkrankheit.** [A copper-containing slag as a substitute for copper sulphate in the control of reclamation disease.]—*Bodenk. u. PflErnähr.*, N.F., xx, pp. 225–247, 1941. [Abs. in *Chem. Zbl.*, cxii (i), 17, p. 2306, 1941.]

The outcome of experiments at the Oldenburg Agricultural Research Station indicated that equal quantities of copper, whether contained in copper sulphate or in copper slag, are equally effective against reclamation disease [of cereals: see preceding and next abstracts], misgivings regarding residues of zinc and lead compounds in the latter proving to be groundless. However, the high copper content of the grain in the untreated portions of the experimental area casts some doubt on copper deficiency as the exclusive cause of the disease and suggests the involvement of physiological factors in the therapeutic action of copper fertilizers.

RADEMACHER (B.). **Versuche über die Brauchbarkeit einer gemahlenen Kupferschlacke der Norddeutschen Affinerie-Hamburg als Kupferdünger.** [Experiments on the utility as a copper fertilizer of a ground copper slag of the North German Refinery, Hamburg.]—*Bodenk. u. PflErnähr.*, N.F., xx, pp. 247–256, 1941. [Abs. in *Chem. Zbl.*, cxii (i), 17, p. 2306, 1941.]

In experiments at the Hohenheim Plant Protection Station copper slag, even in substantial amounts, failed to give adequate control of severe copper deficiency symptoms [as expressed in reclamation disease of cereals: see preceding abstracts], but proved useful both in mild cases of this disturbance and in prophylactic applications to ensure a reserve in the soil.

TEAKLE (L. J. H.), THOMAS (I.), & TURTON (A. G.). **Experiments with micro-elements for the growth of crops in Western Australia. I. Experiments in the Wheat belt with cereals.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xviii, 1, pp. 70–86, 1941.

During 1940, further experiments were carried out in the wheat belt of Western Australia to find new areas responding to micro-element fertilizers and to determine the value of other sources of copper than refined copper sulphate [*R.A.M.*, xix, p. 651]. The results showed that certain soil types in the Dandaragan district and a variety of the sandy and gravelly 'wodjil' soils were found to be acutely deficient in copper with respect to the growth of oats, wheat, and subterranean clover [*Trifolium subterraneum*], while other types appeared mildly deficient.

Certain wheat varieties, e.g., Bencubbin and Nabawa, on some copper-deficient soils, showed a purplish discoloration of the stalks and leaf sheaths. Wheat grown on copper-treated areas in copper-deficient soil had a more attractive appearance than that grown in the untreated soil. On soil acutely deficient in copper wheat sometimes failed to produce grain, and the empty heads stood erect, while in the case of oats the husks were pale and empty. Oats occasionally showed papery glumes. There was also a tendency to secondary tillers in late spring.

Some of the copper-deficient soils gave a better response when treated with impure copper fertilizers such as oxidized copper ore and roaster residues from pyrites burners than when treated with copper sulphate. This requires further investigation. On the dark grey calcareous soils near Dongarra the roaster residues gave about 30 per cent. improvement in crop, though copper ore was ineffective.

On certain types of 'wodjil' country copper applications produced striking results in the elimination of dummy heads. Growers are advised, before purchasing large quantities of copper sulphate, to carry out preliminary trials to ascertain whether their type of soil responds to the treatment; strips across the suspected soil types should be given a superphosphate-copper sulphate mixture supplying the latter ingredient at the rate of not more than 5 lb. per acre.

Determination of the copper content of oat leaves not later than six weeks after planting may indicate acute copper deficiency in the soil. Subterranean clover is even more useful for this purpose, substantial differences being observed between the copper content of leaves from control areas on acutely deficient land and adjacent treated areas.

GORDON (W. L.) & SPRAGUE (R.). **Species of Fusarium associated with root rots of the Gramineae in the Northern Great Plains.**—*Plant Dis. Reptr*, xxv, 7, pp. 168–180, 1941. [Mimeographed.]

The following species of *Fusarium* were collected during 1940 on cereals and grasses affected by root rot in the Northern Great Plains, United States, and isolated from the diseased parts after surface sterilization in calcium hypochlorite (48 gm. in 450 c.c. water) on potato dextrose or non-nutrient agar: *F. culmorum*, *F. equiseti*, *F. graminearum* [*Gibberella saubinetii*], *F. moniliforme* [*G. fujikuroi*], *F. oxysporum*, *F. poae*, *F. scirpi* and its vars. *acuminatum*, *compactum*, and *longipes*, *F. solani* and its var. *martii*, and *F. sporotrichoides*. Out of a total of 1,715 isolations, *F. equiseti*, *F. oxysporum*, and *F. scirpi* var. *acuminatum* accounted for 45·77, 43·73, and 6·36 per cent., respectively. *F. equiseti* predominated among the material collected in the early part of the season (12th May to 30th June), while *F. oxysporum* was more in evidence from 1st July to 15th August; *F. scirpi* var. *acuminatum* was more common than *F. oxysporum* in the collections made between 12th and 31st May but declined in prevalence later. None of these three species, which together constituted 95·86 per cent. of the total number of isolations, is generally recognized as a serious pathogen of Gramineae, whereas the definitely parasitic *G. saubinetii* and *F. culmorum* were seldom observed, comprising only 0·18 per cent. of the whole. The relative unimportance of species of *Fusarium* in comparison with *Helminthosporium sativum* in the etiology of the cereal and grass root rot complex in 1940 is thus readily explicable.

D'OLIVEIRA (B.). **Notas sobre a produção da fase aecidica de algumas ferrugens dos cereais em Portugal.** [Notes on the production of the aecidial stage of some cereal rusts in Portugal.]—*Rev. agron., Lisboa*, xxviii, 2, pp. 201–208, 1940. [English summary.]

Since 1934 the author has been engaged on the study of the aecidial phase of the principal cereal rusts (*Puccinia* spp.) in Portugal [*R.A.M.*, xx, p. 53], where teleutospore germination commonly occurs in the autumn and is not necessarily followed by a resting period prior to maturation in the cold weather, at any rate in the south of the country. The aecidia of *P. graminis* have not been found in Portugal, but those of *P. rubigo-vera tritici* (*P. triticina*) were observed as early as October near Lisbon on *Thalictrum flavum* subsp. *glaucum*. Only six of the 22 *T.* spp. inoculated with the wheat leaf rust proved to be immune, viz., *T. aquilegifolium*, *T. asplenifolium*, *T. dipterocarpum*, *T. hemense*, *T. palmatum*, and *T. simplex*, while particularly heavy infection occurred on *T. flavum*, *T. laserpitiifolium*, *T. minus*, *T. petaloideum*, and *T. ruthenicum*.

*P. rubigo-vera secalis* (*P. dispersa*) [*P. secalina*] forms aecidia in the utmost profusion throughout the country on *Anchusa* spp. and *Echium tuberculatum* from the onset of the autumn rains to the end of the winter.

The aecidial stage of *P. anomala* has not been observed in nature in Portugal, but inoculation experiments on *Ornithogalum concinnum*, *O. divergens*, *O. narbonense*, *O. umbellatum*, and *O. unifolium* resulted

in abundant infection, whereas *O. pyrenaicum* was immune and *O. arabicum* nearly so.

In the central and southern regions *Rhamnus alaternus* commonly shows heavy infection by the aecidia of *P. coronata avenae*, from which *R. frangula* and *R. oleoides* are immune.

The precocious development of the aecidial stage of the rusts under observation appears to constitute a very important source of infection for cereal crops in October and November, but from December onwards the partiality of snails and slugs for the pustules largely arrests the further production of aecidia.

BARTLETT (H.). **New Wheats for the North West.**—*Agric. Gaz. N.S.W.*, lii, 4, pp. 184–188, 4 figs., 1941.

A new wheat variety, Fedweb I, produced by W. L. Waterhouse from Federation and Webster for cultivation in the north-western area of New South Wales is stated to be resistant to all 7 races of stem rust [*Puccinia graminis*: *R.A.M.*, xviii, p. 239] found in Australia, including race 34. In tests in Queensland under conditions highly favourable to rust, small linear pustules developed on the stems, but satisfactory grain was produced. Fedweb shows moderate resistance to leaf rust [*P. triticina*], but is susceptible to flag smut [*Urocystis tritici*]. The Eureka variety [ibid., xviii, p. 655] (a selection from the cross Kenya × Florence × Dundee) has the high resistance to stem rust of the Kenya parent, and since its release in 1938 has made rapid progress in areas where infection is prevalent. It is, however, highly susceptible to *Septoria* leaf spot [*S. tritici*]. Bordan is almost as resistant as Ford to stem rust and is superior in flag smut resistance.

NEWTON (MARGARET) & JOHNSON (T.). **Environmental reaction of physiologic races of Puccinia triticina and their distribution in Canada.**—*Canad. J. Res.*, Sect. C, xix, 4, pp. 121–133, 1941.

In experiments conducted in 1936 and 1939 at Winnipeg, it was found that the reactions of the differential varieties of wheat to physiologic races of *Puccinia triticina* [*R.A.M.*, xx, p. 54] are influenced by temperature and, in a lesser degree, by light. At lower temperatures (the experimental range being 57° to 75° F.) the varieties Malakoff, Norka, and Democrat became increasingly susceptible, and Carina, Brevit, and Hussar increasingly resistant, while Webster and Mediterranean were not consistent in either direction, and Loros was little influenced by temperature. All eight varieties showed a more or less marked tendency to become increasingly resistant under conditions of short day length and low light intensity.

Surveys of physiologic races of *P. triticina* in Canada carried out with some interruptions since 1931 have established the presence of 49 races, of which the predominant (2, 5, 9, 15, 31, 32, 34, 52, and 89) are distributed throughout the country. However, races 1, 58, 76, and 81 are largely confined to Eastern Canada (Ontario, Quebec, and the Maritime Provinces), except that in 1940 each of the three first-named races was collected once in the prairie region of Western Canada. Race 11 was collected 17 times from British Columbia, twice in Alberta, and once in the Maritime Provinces; race 53, seven times in British Colum-

bia, twice in Alberta, and twice in Manitoba. Races 5, 31, 44, and 52, found commonly in the prairie region, have never been collected in British Columbia. The fact that most races were collected year after year is taken as an indication that no radical change in respect of identity and relative prevalence has occurred in leaf rust during the past few years in Canada.

JOHNSTON (C. O.). **Some species of Triticum and related grasses as hosts for the leaf rust of Wheat, Puccinia triticina Erikss.**—*Trans. Kans. Acad. Sci.*, xliii, pp. 121–132, 1940.

Seedlings of one or more varieties of 19 species of *Triticum*, four of rye, 11 selections of wheat × rye hybrids, one sample of Michel's grass, a perennial believed to be the result of a cross between Mosida wheat (*T. vulgare*) and *Elymus condensatus*, one of *E. condensatus*, varieties of 18 species of *Aegilops*, and 15 species of *Agropyron* were tested with several physiologic races of *Puccinia triticina* [*R.A.M.*, xix, p. 139] in the greenhouse at the Kansas State College.

More selections resistant to races 5, 9, and 15 were found in 7- and 14-chromosome groups than in the 21 group. *T. timopheevi*, *T. dicoccum* var. Vernal, and *T. pyramidale* [var.] *copticum* were nearly immune from all three races, while *T. turgidum*, *T. monococcum* (einkorn), *T. durum* (Kubanka), and *T. aegilopoides* var. *pancici* were highly resistant. The four rye varieties, Abruzzi, Balbo, Kansas winter, and common spring, were immune or virtually so from infection by all three races, while ten of the eleven wheat × rye hybrids were susceptible. All the amphidiploid selections were susceptible. Michel's grass, which resembles rye in plant habit, was likewise highly resistant to the three races. *E. condensatus* was susceptible to 5 and 15, but the reactions of individual seedlings to race 9 were variable. Most of the *Aegilops* spp. were resistant to races 5, 9, 15, 28, and 37, but *A. ovata* [var.] *globulosa* and *A. sharonensis* were susceptible to all five, and *A. crassa* [var.] *rufescens* to all but race 5. Two lots of *A. cylindrica* exhibited strong differential reactions, characterized by susceptibility to races 9 and 37 and high resistance to 5, 15, and 28. Most of the 15 species of *Agropyron* tested were highly resistant to the five races of *P. triticina* used in the tests, though uredosori developed on six. *A. spicatum* was moderately susceptible to all the races except 9, while *A. subsecundum* was resistant to all but 37 and *A. inerme* to all but 9. Uredospores transferred from *A. desertorum*, *A. sibiricum*, *A. trichophorum*, *A. inerme*, *A. spicatum*, and *A. subsecundum* to Hybrid No. 128 wheat seedlings produced normal infection in each case. Two $F_3$ lines of *T. vulgare* × *A. elongatum* were nearly immune from all five races of the rust.

MIDDLETON (G. K.) & CHAPMAN (W. H.). **Resistance to floral-infecting loose smut (Ustilago nuda) in fall-sown Barley varieties at Statesville, North Carolina.**—*Phytopathology*, xxxi, 4, pp. 351–353, 1941.

The following average loose smut (*Ustilago nuda*) percentages were secured in ten barley varieties in a three-year (1937 to 1939) series of inoculation experiments by M. B. Moore's partial vacuum method [*R.A.M.*, xv, p. 567]: North Carolina Bearded 70, 45·0; Tennessee Hooded 36·5; N.C. Bearded 68, 34·6; N.C. Bearded 83, 20; Tennessee

Winter 10·0; N.C. Beardless 26, 6·7; and N.C. Beardless 23, N.C. Bearded 11 and 15, and Odessa, all 0. The best results were obtained when the inoculations were carried out from the second to the fifth day after the emergence of the heads from the 'boot', with the peak on the fourth. From inoculations on this day, 6 out of 9 heads of Tennessee Hooded and 7 out of 10 of N.C. Bearded 68 produced some diseased plants in the following season. Using Tapke's method of puncturing the glumes and inserting the inoculum with forceps in the spring of 1939, 7·9 and 1·2 per cent. infection developed in 1940 on Odessa and N.C. Bearded 15, respectively, but none on N.C. Beardless 23 and N.C. Bearded 11. Improved technique is therefore needed if fine distinctions are to be made between varieties.

HAYES (H. K.). **Barley varieties registered, VI.**—*J. Amer. Soc. Agron.*, xxxiii, 3, pp. 252–254, 1941.

Of the three barley varieties approved for registration in 1940, Barbless, Reg. No. 11, has given evidence of high resistance to stripe disease (*Helminthosporium gramineum*).

STANFORD (E. H.) & BRIGGS (F. N.). **Two additional factors for resistance to mildew in Barley.**—*J. agric. Res.*, lxi, 3, pp. 231–236, 1941.

Continuing their studies in California on the inheritance of resistance to mildew (*Erysiphe graminis hordei* race 3) in barley [*R.A.M.*, xviii, p. 515], the writers investigated the factors involved in this process in two additional resistant varieties, Psaknon and Duplex. The Psaknon (*Mlp*) factor found in Psaknon is dominant in effect and identical with one of the two factors previously reported in Arlington Awnless, Nigrate, and Chinerme; henceforth it will replace the *Mlx* factor designation provisionally assigned to these three varieties. A new factor found in Duplex combined with two previously identified factors, *Mlh* and *Mlp*, is recessive in effect and is designated the Duplex (*mld*) factor. In all, there are seven distinct factors for mildew resistance, one of which is recessive, the number in a single variety ranging from one to three. Two of the seven identified are definitely linked, while a third, the Duplex factor, may be linked with either the Hanna or the Psaknon. The single factor for resistance to race 6 of barley mildew found by Tidd (*Phytopathology*, xxx, 1, pp. 24–25, 1940) in a cross between the resistant Nepal 595 and the susceptible Featherstone must differ from any of those reported in the present series of experiments, since Nepal is completely susceptible to race 3.

GORTER (G. J. M. A.). **Stripe- or yellow-leaf disease of Oats.**—*Fmg S. Afr.*, xvi, 181, p. 140, 1941.

Early in the winter of 1940, oat plants received at Stellenbosch aboratory were found to be infected by *Helminthosporium avenae* *R.A.M.*, xvii, p. 809], not previously recorded from the Union of South Africa, perhaps because farmers have overlooked it. The ascospore stage (*Pyrenophora avenae*) [ibid., xiv, p. 690] in the author's material occurred mainly in the vicinity of the nodes. Control is advised by seed disinfection, the ploughing-in of old stubble, and crop rotation.

STANTON (T. R.). **Registration of varieties and strains of Oats, X.**—*J. Amer. Soc. Agron.*, xxxiii, 3, pp. 246–251, 1941.

During 1940 the following six varieties of oats were approved for registration: Fultex, Reg. No. 92, resistant to smuts (*Ustilago avenae* and *U. levis* [*U. kolleri*]) and crown rust [*Puccinia coronata*]; Vicland, Reg. No. 93, resistant to the races of smuts and rusts predominating in the north-central States; Ranger and Rustler, Reg. Nos. 94 and 95, resistant to the races of crown rust and smut prevalent in Texas; Huron, Reg. No. 96, highly resistant to smut; and Uton, Reg. No. 97, highly resistant to the Utah races of smuts.

TINGEY (D. C.), WOODWARD (R. W.), & STANTON (T. R.). **Uton : a new high-yielding white Oat resistant to loose and covered smuts.**—*Bull. Utah agric. Exp. Sta.* 296, 15 pp., 2 figs., 1941.

This is a detailed, tabulated account of the performance of Uton, the new variety of white oats derived from a cross between Markton and Swedish Select which has given such promising results in recent tests in Utah both in respect of productivity and resistance to loose and covered smuts (*Ustilago avenae* and *U. levis* [*U. kolleri*: see preceding abstract]).

**Pathology and mycology of Corn.**—*Rep. Ia agric. Exp. Sta., 1939–40,* Part II, pp. 48–54, 1940.

In studies on maize diseases carried out in Iowa in 1939–40 [cf. *R.A.M.*, xix, p. 337] I. E. Melhus grew *Diplodia zeae* on media containing various carbon and nitrogen sources to determine their effect on growth. Determinations of the dry weight of mycelium resulting after spore inoculations indicated that the greatest growth occurred when asparagin was the nitrogen source, production on nitrate being next, and frequently not significantly different from that formed on ammonium salts. In a comparison of the carbon sources, with asparagin as a nitrogen source, the dry weight yield was greatest on starch, decreased in order with dextrose, maltose, dextrin, and was least with sucrose. In the case of all sources of carbon with asparagin as a nitrogen source the dry matter yield at 42 days was less than that at 21 days, this being true only with starch in the nitrate and ammonium series. The final $P_H$ value of the different test materials appeared to depend on the nitrogen source. Attempts to eliminate micro-elements by absorption in charcoal gave conspicuously diminished yields at 21 days, but at 42 days the yield from the cultures without micro-elements was equal to that from those with them.

Comparative pathogenicity tests with *D. zeae* and other fungi isolated from maize roots in different parts of Iowa showed that the fungi concerned fell into three groups with respect to virulence, viz., (1) severe, *Pythium graminicola*, *Rhizoctonia* [*Corticium*] *solani*, (2) moderate, *D. zeae*, *Gibberella saubinetii*, *Helminthosporium sativum*, *P. de Baryanum*, (3) slight to none, *Trichoderma lignorum* [*T. viride*], *Aspergillus niger*, *Penicillium oxalicum*, *Fusarium moniliforme* [*G. fujikuroi*], *Basisporium gallarum* [*Nigrospora* sp.], *Monotospora* sp. and *Fusarium* sp.

The succession of the pathogenic fungi on the roots and mesocotyls

of maize plants was followed in the laboratory and the field. As a rule, *Pythium de Baryanum* became parasitic before and after emergence, causing seed decay and stunting. Somewhat later, when the soil reached a higher temperature, *P. graminicola* appeared on the terminal portions of the roots, causing rapid necrosis.

C. S. Reddy found that susceptibility of yellow dent maize inbreds and hybrids to *Nigrospora* sp. is correlated with an immature condition of the ears when translocation ceases in autumn. Analysis of cob tissues from susceptible and resistant materials for sugars, protein, hemicellulose, lignin, and so forth, appeared to show only one constant difference, the presence of more sugar in susceptible than in resistant material. Equalization of sugar percentages between such materials did not, however, result in equally favourable growing conditions for *N.* sp. in culture. The material which appears to favour growth in susceptible tissues was found to be soluble in water and in 95 per cent. alcohol, to remain unabsorbed on charcoals, and to be undamaged, apparently, by autoclaving. A substance strongly inhibiting the growth of *N.* sp. was extracted from susceptible cob tissues gathered in late autumn. This substance was soluble in ether and in water.

In investigations by G. Semeniuk, I. E. Melhus, C. S. Reddy, W. E. Loomis, G. F. Sprague, and E. W. Lindstrom, 91 inbred lines and 23 single and double crosses of maize were tested in the field after pollination for their reaction to artificial inoculation with *D. zeae* and *G. saubinetii*. Highly significant differences in the spread of the fungi were shown on the inbred lines, but on the crosses there were slight or no significant differences. During the period under review the prevalence of natural stalk infection by *D. zeae* was greater than at any time since 1932. Highly significant differences were found in the susceptibility of different inbred lines and crosses to natural infection and stalk-rotting, but the mean infection of the crosses was as great as that of the inbred lines. In other tests by I. E. Melhus and R. Wilkinson more smut (*Ustilago zeae*) occurred in inbreds than in single crosses.

Kernkamp (M. F.) & Petty (M. A.). **Variation in the germination of chlamydospores of Ustilago zeae.**—*Phytopathology*, xxxi, 4, pp. 333–340, 2 figs., 1941.

In studies at the Minnesota Agriculture Experiment Station on the germination of chlamydospores derived from eight field collections, four crosses between monosporidial lines, and two monosporidial diploid lines of *Ustilago zeae* on potato dextrose agar, 25 germination types were observed [*R.A.M.*, xviii, p. 670; xix, p. 652], of which the production of the supposedly normal four-cell promycelium, with a sporidium on each cell, was not the most characteristic or prevalent. The following were the five most prevalent germination types and the number of crosses or collections in which each predominated: promycelia bearing one or more hyphal branches in place of sporidia (5); chlamydospores functioning as basal promycelial cells, thus forming sporidia directly on the spore (4); chlamydospores with two opposite promycelia (2); four-cell promycelia (2); and lysing promycelia (1).

Genetic factors appear to determine the tendency towards a given germination type.

KARPER (R. E.). **Registration of improved Sorghum varieties, II.**—*J. Amer. Soc. Agron.*, xxxiii, 3, pp. 257–258, 1941.

The two sorghum varieties approved for registration in 1940, Coes, Reg. No. 77, and Highland, Reg. No. 78, are both susceptible to smuts [*Sphacelotheca sorghi* and *S. cruenta*] but resistant to 'weak neck' [*R.A.M.*, xviii, p. 99].

WAGER (V. A.). **The November-drop and navel-end-rot problems of Navel Oranges.**—*Fmg S. Afr.*, xvi, 181, pp. 143–144, 4 figs., 1941.

This paper on November drop and basal end rot of Washington Navel oranges in South Africa, the latter condition being due to *Alternaria citri*, is a condensed version of two bulletins already noticed [*R.A.M.*, xix, pp. 401, 699].

DOIDGE (E[THEL] M.). **Scaly bark or psorosis of Citrus trees in South Africa.**—*Sci. Bull. Dep. Agric. S. Afr.* 208, 31 pp., 12 pl., 1939. [Received May, 1941.]

This is a useful summary of the position at the date of writing in regard to the knowledge of the etiology, mode of transmission, and control of citrus psorosis, with special reference to South African conditions [*R.A.M.*, xix, p. 86; xx, p. 200]. Most of the work referred to has already been noticed from other sources, but mention may be made of a superficial scaling of Natal Tight Skin tangerines inoculated with bark grafts from diseased trees which is apparently a form of psorosis. The condition, known as 'warmbaths disease', is characterized by the peeling-off of thin pieces of outer bark, $\frac{1}{2}$ to $\frac{3}{4}$ in. in diameter, followed by healing with a slight scar and the repetition of the process elsewhere. In a concluding section brief observations are made on some obscure bark disorders liable to confusion with psorosis, including one resembling leprosis [ibid., xix, p. 85] and a curious type of bark scaling in which parallel cracks up to 9 in. long develop on the branches, converging upwards to meet in the shape of a spearhead. The outer cortex finally peels off, revealing longitudinal fissures down the centre of the lesions in the inner bark, exposing the wood. Callus is formed at the edges of the cracks and partial healing ensues, but an unsightly central scar is usually left. Considerable quantities of gum may be exuded from small branches in the incipient stages of cortical cracking. In one orchard the incidence of this trouble increased from 50 to nearly 100 per cent. in the space of a few months, and the death of some of the affected trees is expected. Valencia oranges on a waterlogged area of the Mazoe Estate, Southern Rhodesia, developed small, raised areas, exactly similar to those of psorosis, in the outer bark, corresponding to the emergence of firm, woody excrescences from the cambium. The lesions gradually expand and the bark peels off, with practically no extrusion of gum, which is present, however, in appreciable amounts in the wood a short distance below the cambium.

Fawcett (H. S.). **Citrus viruses.**—*Phytopathology*, xxxi, 4, pp. 356–357, 1941.

The writer gives the definitions of the four citrus viruses for which the names of *Citrivir italicum*, *C. psorosis*, *C. psorosis* var. *vulgare*, and *C. psorosis* var. *anulatum* have already been proposed [*R.A.M.*, xx, p. 175]. It is possible that concave gum disease and blind pocket may also be caused by strains of the psorosis virus, in which case they would be classified as vars. *concavum* and *alveatum*, respectively [ibid., xviii, p. 100].

Griffith (E. B.). **Economic importance of Oak root fungus.**—*Calif. Citrogr.*, xxvi, 6, pp. 153, 180, 2 figs., 1941.

In this paper, read at a meeting of growers in California, the author states that *Armillaria mellea* [*R.A.M.*, xi, p. 40; xvii, p. 162] is becoming increasingly common every year in Californian orange groves. It is essential that control measures be instituted as soon as the disease is recognized. All diseased trees must be removed. The exact limits of the infected area must be determined by examining the roots and all vegetation in the area must then be killed by the application of a sufficient quantity of carbon disulphide. After about a month the treated area may be replanted with young trees. If slight infection recurs after two or three years, the limits of the infection must be found and the small area affected fumigated again. It can then be once more replanted, with little likelihood of the disease recurring.

Shtshepkina (Mme T. V.). Описание эндопаразитов хлопковых волокон. [The description of endoparasites in Cotton fibres.]—*Bull. Acad. Sci. U.R.S.S., 1940*, Sér. biol., 5, pp. 643–661, 6 figs., 1940. [English summary.]

The micro-organisms detected within cotton fibres by the colorimetric method described in a previous paper [*R.A.M.*, xvii, p. 173] were tentatively identified in pure culture as Hutchinson and Clayton's cytophaga, *Micropolispora cellulosisolvens*, *M. disjungens*, *Actinomyces penicilloides*, and *A. citromycelloides*, all of which are believed to be parasitic on cotton, being observed in fibre and seeds. *Proactinomyces catenulatus*, found developing within the cells of *Alternaria* in cotton fibres, is believed to be parasitic both on cotton and *Alternaria*.

Dunlap (A. A.). **Inoculation of Cotton plants in sand culture with Phymatotrichum root rot.**—*Phytopathology*, xxxi, 4, pp. 358–361, 2 figs., 1941.

The following procedure gave satisfactory results in the inoculation of mature Rogers' Acala cotton plants with *Phymatotrichum omnivorum* in the greenhouse at the Texas Agricultural Experiment Station [*R.A.M.*, xx, p. 113]. A small mass of sterile Houston black clay soil was placed round the stem of the plant at the surface of the sand cultures, close to the stem, the surface sand being removed for this purpose. Inoculum in the form of one-month-old sclerotia was placed near the stem on this soil and another layer of soil was placed directly on top, making a small mound 6 to 8 cm. in depth, which was pressed firmly against both the plant stem and the sand. Within three weeks

of inoculation, 68 out of the 75 plants (91 per cent.) used in the test were reduced to a state of permanent wilting, while the remaining seven developed root lesions that would probably have resulted in eventual death. The first symptoms of wilting appeared in some of the plants as early as 8 to 10 days after inoculation, the process being completed in an average of 14·5 days.

BELTYUKOVA (Mme K. I.). **The antagonistic and stimulating effects of B. mesentericus on Bact. malvacearum, the agent of Cotton gummosis.**—*Mikrobiol. Zh.*, vii, 1–2, pp. 209–222, 1940. [Russian, with English summary.—Abs. in *Chem. Abstr.*, xxxv, 8, p. 2563, 1941.]

*Bacillus mesentericus* is stated to secrete a filter-passing, thermostable, specific substance which at low concentrations exerts a stimulatory action (synergy) on *Bacterium malvacearum*, the agent of cotton gummosis [blackarm]. In laboratory experiments the incidence of infection on the cotyledons of seedlings raised from seed treated with substantial amounts of the toxin was appreciably reduced, whereas small doses enhanced susceptibility to the disease.

THORBURN (ALICE M.) & VINCENT (J. M.). **Protection of cloth against microbial deterioration—methods of testing the value of antiseptics.** —*J. Aust. Inst. agric. Sci.*, vii, 1, pp. 29–31, 1941.

Simple tests are described for assessing the value of antiseptics in the protection of cotton fabrics under practical conditions. The authors' methods were to spray areas of cloth of known weight with enough solution to give amounts of antiseptic equivalent to a range of acid trichlorphenol on a cloth weight basis. All pieces of cloth in any one series received approximately equal volumes of solution applied to both sides. After treatment, the cloth was hung out to dry, wrapped, and stored in a dry cupboard until tested. Two simple methods for storage tests under humid conditions were devised. In one, pieces of cloth were exposed in small, dry, shallow dishes in larger Petri dishes containing free water, only one concentration being exposed within any closed vessel. In the other, cloth strips were immersed to about one-fifth of their height in water in unstoppered test tubes. In each case the cloth was examined for mould, and assessment made in comparison with controls.

Results obtained by this technique showed that considerably higher concentrations of the trichlorphenol and its sodium salt are required in the authors' test than when Hatfield's method [*R.A.M.*, xv, p. 69] is used; the free acid was less effective than the sodium salt, and with both there was steady loss of protective power with continued exposure, particularly with the free acid.

In tests of the ability of antiseptics to resist leaching by rain, pieces of treated and untreated material were cut to fit the bottom of 9 cm. Buchner funnels. A given head of distilled water was kept over the cloth for regular intervals, then allowed to run through it, and replaced by the next volume. To expedite the test and facilitate differentiation, the pieces of cloth were saturated with 1 per cent. sucrose before incubation. In this experiment, sodium salts of trichlorphenol and salicylanilide showed small resistance to leaching.

Resistance to evaporation was tested by exposing sprayed cloth to a fan for seven days, and comparing subsequent protection in a humid atmosphere with that of cloth similarly sprayed but kept in a closed container, both series being heavily inoculated with *Aspergillus niger* spores. The cloth exposed to the fan, whether treated with the acid or the sodium salt, showed heavy growth at from 0·5 to 1 per cent., whereas in both treatments the cloth kept in containers during storage gave full protection as low as 0·5 per cent.

Hatfield determined the 'killing' concentration by removing inoculum blocks which had been in contact with the antiseptic-treated agar on to fresh slopes of malt agar, and regarded growth failure in the transplant as evidence of death at that concentration. The authors point out that such prevention of growth might be due to persistent inhibition by reason of substance carried over in the inoculum block diffusing into the fresh medium. In their own experience, 0·01 per cent. trichlorphenol inhibited growth, and the inoculum when removed to a fresh slope failed to grow, but fresh spores also failed to grow on this slope. The same inoculum, when removed, soaked in sterile water, and then placed on a fresh slope grew abundantly. A true killing effect was, however, demonstrated with higher concentrations.

HEGARTY (F. A.) & WEIDMAN (F. D.). **Symposium on fungous infections. Clinical aspects of fungous infections. The laboratory aspects of fungous infections.**—*Penn. med. J.*, xliv, 7, pp. 847–855, 1941.

F. A. Hegarty's contribution to the present series of studies on fungal diseases of man consists of descriptions of the clinical manifestations of some well-known types of ringworm, favus, moniliasis, tinea, onychomycosis, blastomycosis, and sporotrichosis, while F. D. Weidman gives particulars of laboratory methods for use in the collection, microscopic examination, staining, and cultural identification of the causal organisms.

WADE (L. J.) & STEVENSON (L. D.). **Torula infection.**—*Yale J. Biol. Med.*, xiii, 4, pp. 467–476, 4 figs., 1941.

Full clinical details are given of a case of meningo-encephalitis in a 39-year-old German-born woman in New York, from whose cerebrospinal fluid *Torula histolytica* [*Debaryomyces neoformans*: *R.A.M.*, xx, p. 202, and next abstracts] was isolated in the course of a post-mortem examination and shown by inoculation experiments to be pathogenic to mice, giving positive results (mostly involving the lungs) in 36 out of 40 cases.

BINFORD (C. H.). **Torulosis of the central nervous system. Review of recent literature and report of a case.**—*Amer. J. clin. Path.*, xi, 3, pp. 242–251, 3 figs., 1941.

Following a review of recent literature on torulosis of the central nervous system, accompanied by a table presenting the salient features of 14 cases, the writer describes a non-fatal case of the disease in a 41-year-old male treated at the United States Maine Hospital, Detroit, Michigan, in 1939. *Torula histolytica* [*Debaryomyces neoformans*: see preceding and next abstracts] was isolated on blood agar from nodules

in the groin of a guinea-pig inoculated with the patient's cerebrospinal fluid and injected into mice and other guinea-pigs with positive results.

STILES (W. W.) & CURTISS (A. N.). **Torula meningoencephalitis. Report of a case: observation of the cerebrospinal fluid.**—*J. Amer. med. Ass.*, cxvi, 15, pp. 1633–1635, 1 graph, 1941.

Full clinical details are given of a fatal case of meningo-encephalitis in a 63-year-old male admitted to the Syracuse (New York) Memorial Hospital in 1938. *Torula histolytica* [*Debaryomyces neoformans*: see preceding abstracts] was isolated on plain, rabbit's blood, and Sabouraud's agars at 37° C. from samples of the spinal fluid and experimentally shown to be pathogenic to mice and in one instance also to a rabbit, the fungus being recovered from the invaded tissues.

HOWELL (A.). **Studies on Histoplasma capsulatum and similar form-species. III. Effect of hydrogen ion concentration.**—*Mycologia*, xxxiii, 1, pp. 103–117, 3 figs., 2 graphs, 1941.

In further studies of this series [*R.A.M.*, xx, p. 61] it was found that on the synthetic media used, the optimum H-ion concentration for the growth and sporulation of *Histoplasma capsulatum* was approximately $P_H$ 6·5 to 7·5 and for *Sepedonium chrysospermum* $P_H$ 6·5 to 7. When the carbohydrate-amino acid balance in the colonies was changed, corresponding changes also occurred in the acidity of the substratum. Thus, when the ratio of carbohydrates to amino acids was 15 to 1·8 the medium remained relatively constant, while with a ratio of 16 to 0·24, the medium became definitely more acid.

ORMSBY (O. S.). **Mycotic infections of the skin.**—*New Engl. J. Med.*, ccxxiv, 16, pp. 673–678, 1941.

This is a review of current development in the study of ringworms of the hands and feet (*Epidermophyton* and *Trichophyton* spp.), which are stated to have been practically unknown in the United States until 1916, and yeast dermatoses (moniliasis), most commonly associated with *Monilia* [*Candida*] *albicans*. The clinical features, diagnosis, etiology, and therapy of the various disorders under investigation are clearly described.

FOWLER (E. P. F.). **The bacteriology of acute otitis media and its course under new and old methods of treatment.**—*Canad. med. Ass. J.*, xliv, 4, pp. 372–380, 3 graphs, 1941.

*Aspergillus niger* was isolated from the aural canal in only four cases (0·05 per cent.) of otitis media in an extensive series of routine cultures in the author's hospital practice in New York [*R.A.M.*, xx, p. 260].

VAN BREE (R. S.). **Moniliasis. Sulfapyridine treatment.**—*J. Mich. med. Soc.*, xl, 3, pp. 197–199, 4 figs., 1941.

A clinical description is given of a long-standing case of gastro-intestinal and pulmonary moniliasis in a 49-year-old male at Grand Rapids, Michigan, to which special interest is considered to attach in view of the scarcity of reports in the literature in which the etiology

of the disease has been clearly demonstrated. In the present instance, a species of *Monilia* [? *Candida*] was isolated from the throat, bile, faeces, and sputum, the injection of a pure culture of which into a rabbit caused death, the histological symptoms being consistent with those of fungal invasion. The patient's symptoms responded favourably to sulphapyridin therapy.

ZEROVA (Mme M. Y.). Хвороби Лілій в київських квітівництвах. [Diseases of Lilies in Kieff nurseries.]—*J. Bot. Acad. Sci. Ukr.*, i, 1, pp. 143–147, 7 figs., 1940. [English summary.]

Observations of recent years in Kieff (Ukraine) nurseries showed that bulb rot caused by *Fusarium redolens* and leaf spot due to *Cercosporella inconspicua* [*R.A.M.*, iv, p. 672] are the two most important and widespread diseases of lilies. Less destructive are brown leaf spot (*Botrytis elliptica*) [ibid., xviii, p. 443] and the grey rot of buds and flowers (*B. cinerea*) [ibid., xiii, p. 704] observed in summer during periods of prolonged warm and moist weather or after continual rain. Of the lily species cultivated at Kieff, *Lilium candidum* proved to be the most susceptible to all diseases, while *L. harrisii* and *L. regale* suffered more severely from *C. inconspicua* than from *F. redolens*; the two *Botrytis* diseases were found on all varieties of lilies, but were not widely distributed. Plants attacked by *F. redolens* and *C. inconspicua* sometimes died off on entire sections of the nursery as early in the season as before or during flowering. High temperature and moisture content of the soil are essential for the development and spread of *F. redolens*. Good control of the disease resulted from drying slightly infected bulbs at about 38° C. for three to four weeks before storing; severely infected bulbs should be destroyed. *C. inconspicua* infection, which appeared in some years at the very beginning of the vegetative period and lasted till the autumn, is a limiting factor in lily cultivation. The disease retards the growth and flower development of the plant and spoils their appearance through spotting. The development of this disease is somewhat arrested by an early application of Bordeaux mixture.

DODGE (B. O.) & LASKARIS (T.). **Botrytis core-rot of Gladiolus.**—*J.N.Y. bot. Gdn*, xlii, 496 (Sect. 1), pp. 92–95, 5 figs., 1941.

The spores of the *Botrytis* isolated in pure culture from gladiolus corms affected by core rot on Long Island, New York, measured 12·5 to 21·4 by 8·3 to 13·2 (average 15·8 by 10·5)$\mu$ and thus agree closely with those given by W. C. Moore in his manual of bulb diseases [*R.A.M.*, xix, p. 153] for (?) *B. gladioli* [ibid., x, p. 274]. *Penicillium gladioli* [ibid., xv, p. 468] is commonly found in association with the *Botrytis* in diseased corms and is liable to develop with the latter in cultures from large pieces of tissue. F. L. Drayton (*in litt.*) has informed the writers that the core rot occurs in a destructive form in Canada, a grower near Toronto having recently reported the loss from this cause of 250,000 corms out of a stock of 3,000,000. Control measures should be based on stringent field and storehouse sanitation, special care being taken to dry any corms dug during wet weather, a practice to be avoided whenever possible.

BRIERLEY (P.) & SMITH (F. F.). **Mosaic and streak diseases of Rose.**— *J. agric. Res.*, lxi, 9, pp. 625–660, 10 figs., 1940.

In this paper a full account is given of a detailed study made in the United States from 1932 to 1938 of rose mosaic and its control, in the course of which investigations were also made into a form of streak [*R.A.M.*, xiv, p. 363]. The results obtained may be summarized as follows:

In the Mme Butterfly variety the symptoms of rose mosaic are prominent chlorotic areas feathering away from the midribs of leaflets, and also ring, oak-leaf, and watermark patterns. The yellow types of rose mosaic (which are similar to rose mosaics 2 and 3 of Thomas and Massey [ibid., xix, p. 409]) are characterized by brighter and lighter yellow patterns than are found in typical rose mosaic (Thomas and Massey's rose mosaic 1). Diagnostic symptoms of streak include brown rings, brown or yellow veinbanding, and senescence patterns in leaves, and brownish or greenish ring markings in canes. Some hybrid tea roses show necrotic primary lesions in the canes. Numerous chlorotic speckle and crinkle patterns, including the disorder of Manetti roses known as 'rattlesnake' in the Pacific Northwest are not related to rose mosaic. Field diagnosis of rose mosaic and streak is unreliable, because of the tendency of the symptoms to become masked in some varieties.

The occurrence of rose mosaic was confirmed by its transfer to healthy Mme Butterfly from 17 rose varieties from seven States and the Province of Ontario, but the disease was found to be prevalent only in association with certain propagation practices. Yellow mosaics were observed in scattered single plants in four localities. Streak occurs in Maryland, New York, Texas, Virginia, and District of Columbia, and affected 30 per cent. of the roses in one collection of varieties.

All three diseases were transmitted experimentally only by budding or grafting, and transmission did not take place when the buds were removed before union occurred. The minimum incubation periods for all three were about 20 days, though in some cases incubation required several months. No seed transmission of mosaic or streak was apparent in small populations of seedlings from affected plants. Attempts at insect transmission, using 31 species of insect for mosaic and 34 species for streak, gave negative results.

All rose varieties tested were susceptible to mosaic and yellow mosaic, but showed different degrees of tolerance. Rose varieties and species can be arranged in three groups in respect to streak reaction, viz.: (1) susceptible to systemic infection, (2) subject to primary necrotic lesions in the canes, and (3) resistant. No natural spread of mosaic or streak was observed in field trials in four States, the evidence indicating that spread in nature is probably due to the nursery practice of propagating roses on rooted cuttings taken from the tops of budded understocks of the previous season. The suggestion is put forward that mosaic, and probably the yellow mosaics and streak also, may be controlled by the use of understocks from a mother block indexed to assure freedom from these conditions.

It is believed that streak is unrelated to the mosaics and unlike the necrotic diseases of rose described by Grieve from Australia [ibid., x, p. 733] and Gigante from Italy [ibid., xvi, p. 179].

Rosen (H. R.). **Breeding a disease-resistant red climbing Rose.**—*Science*, N.S., xciii, 2411, pp. 259–260, 1941.

Details are given of the characters and performance of a red climbing rose, Stephen Foster, developed at the Arkansas Agricultural Experiment Station from a cross between a pink-blossomed climber (probably a hybrid of *Rosa setigera*) and the red Hybrid Tea variety Black Knight. It is resistant to powdery mildew [*Sphaerotheca pannosa*] under local conditions, though not immune from the pathogen in inoculation tests, and capable of withstanding very low winter temperatures, both serious sources of trouble among climbing roses in widespread areas of the United States.

Loos (C. A.). **Some diseases of garden plants.**—*Trop. Agriculturist*, xcvi, 1, pp. 22–27, 2 pl., 1941.

Chrysanthemum plants in Ceylon were observed to show a condition in which the lower leaves were dead and hung down alongside the stem. Brown spots ranging from small dots to large blotches were present on the upper leaves, and the flowers and flower buds withered prematurely. *Septoria obesa* [*R.A.M.*, vii, p. 244] was present on every affected plant examined. The pycnidia measured 86 to 173$\mu$ in diameter and the spores were thick and rounded near the base, tapered towards the apex, up to 9-septate, and measured 66 to 87 by 3·2 to 3·6$\mu$. It is thought that spread would be checked by removing the diseased leaves and spraying the plants at frequent intervals with a fungicide.

Marchionatto (J. B.). **Las enfermedades de las Dalias.** [Dahlia diseases.]—*Bol. agríc., Mendoza*, viii, 10–12, pp. 337–341, 5 figs., 1940.

Popular notes are given on the occurrence and control in the Argentine of the dahlia diseases caused by *Entyloma dahliae* [*R.A.M.*, xviii, p. 478], *Botrytis cinerea* [ibid., xviii, p. 295], *Sclerotium rolfsii* [ibid., xiii, p. 327], mosaic, and ring spot or tomato spotted wilt [ibid., xix, pp. 255, 568, *et passim*], transmissible by *Thrips tabaci* and constituting the most serious obstacle to the cultivation of the plant in the localities involved.

Herbert (D. A.). **Puccinia distincta McAlp. as the cause of English Marigold rust.**—*J. Aust. Inst. agric. Sci.*, vii, 1, pp. 27–28, 1941.

In this paper the author presents evidence from field observations and experiments supporting the view that *Puccinia calendulae* McAlp. [1903], causing rust of the English marigold (*Calendula officinalis*), is identical with *P. distincta* McAlp. [1895] from the English daisy (*Bellis perennis*) and with *P. cinerariae* McAlp. from the garden cineraria (*Senecio cruentus*). Examination of Queensland material confirmed Cunningham's observations in New Zealand that *P. cinerariae* McAlp. (1906) and *P. allanii* G. H. Cunn. (1923: from the New Zealand endemic *S. lagopus*) are identical, and also showed *P. calendulae* to be morphologically indistinguishable from them. Experiments showed that *P. calendulae* from marigold readily infects *B. perennis* and cineraria with apparent difficulty. *P. cinerariae* from cineraria infects the marigold and *B. perennis* readily and the cineraria (a host not commonly attacked) with apparent difficulty. *P. distincta* from *B. perennis* infects

marigold readily. The synonymy of *P. distincta* includes *Aecidium calendulae* McAlp. (1896), in addition to the species mentioned above. The fungus is found only in Australia and New Zealand.

ZEROVA (Mme M. Y.). Захворювання Кактусових, спричинені грибаии **Gloeosporium amoenum Sacc., Macrophoma opuntiae phaeacanthae sp. nov., Botrytis cinerea Pers.** [Diseases of Cactus, caused by the fungi *Gloeosporium amoenum* Sacc., *Macrophoma opuntiae phaeacanthae* sp. nov., and *Botrytis cinerea* Pers.]—*J. Bot. Acad. Sci. Ukr.*, i, 2, pp. 301–303, 5 figs., 1940. [English summary.]

The following diseases of *Opuntia phaeacantha* were observed in Kieff (Ukrainian S.S.R.). Anthracnose, caused by *Gloeosporium amoenum*, attacked a great number of plants in the open in the acclimatization plots of the Institute of Botany, causing grey lesions with a yellowish-brown margin on the stems of the plant. The disease usually appeared late in the spring, but with the advent of hot summer days some plants were observed to recover and to develop new stems, while the affected tissue dried up and sometimes fell out. Artificial infection of another species of *Opuntia* [unspecified] with this fungus gave positive results. A disease observed in the greenhouse, characterized by a blackening and wilting of diseased stems, proved to be due to *Macrophoma opuntiae phaeacanthae* n.sp. described [in Ukrainian and Latin] as having immersed, black, globose, thick-walled pycnidia, 384 to 464$\mu$ in diameter, with a short, cylindrical, broad ostiole; short, cylindrical, hyaline conidiophores, 13 to 16 by 2$\mu$; and oval, unicellular spores, 23 to 39·1 by 11·5 to 15$\mu$. *Botrytis cinerea* was also found in the greenhouse causing a stem rot.

HARRINGTON (G. E.). **Thiuram sulfide for turf diseases.**—*Science*, N.S., xciii, 2413, p. 311, 1941.

In tests carried out at the Arlington Experiment Farm, Virginia, and on two golf courses in the vicinity, tetramethyl thiuramdisulphide was applied to three strains of creeping bent grass [*Agrostis stolonifera*] for the control of brown patch (*Rhizoctonia* [*Corticium*] *solani*) [*R.A.M.*, xvii, p. 186] and dollar spot (*Sclerotinia homoeocarpa*) [ibid., xvi, p. 681]. The chemical, mixed with dry sand, was scattered evenly over the area treated and watered in lightly. Treatments were made at weekly intervals, in summer against *C. solani* and in spring and autumn against *S. homoeocarpa*. Both diseases were completely controlled by applications made at the rate of 4 oz. per 1,000 sq. ft. of turf, although the untreated plots showed 70 per cent. infection. The treated turf was also superior in quality to that in other plots to which mercury preparations had been applied. Applications at half-rate were as effective as those at the full rate against *S. homoeocarpa*, but others at quarter-rate gave 7 to 15 per cent. infection.

MYERS (W. M.) & CHILTON (S. J. P.). **Correlated studies of winter-hardiness and rust reaction of parents and inbred progenies of Orchard Grass and Timothy.**—*J. Amer. Soc. Agron.*, xxxiii, 3, pp. 215–220, 2 figs., 1941.

At the United States Regional Pasture Research Laboratory, State

College, Pennsylvania, statistically significant differences in winter injury were observed between 59 parental clones of orchard grass [*Dactylis glomerata*] and 60 of timothy [*Phleum pratense*] during the severe winter of 1939 to 1940, which was preceded by epidemics of *Puccinia graminis* in the former crop and of *P. phlei-pratensis* [*R.A.M.*, ix, p. 459] in the latter. Severity of rust was found to be correlated with the degree of winter injury in the parental clones of timothy, but no corresponding association was observed in the case of orchard grass.

BEAR (E. M.). **Insecticides and fungicides. Parts I and II.**—*Fruit-grower*, xci, 2363, pp. 275–276; 2364, pp. 295–296, 1941.

Useful, practical directions are given for the treatment of fruit trees and bushes with some standard fungicides against a number of common diseases. Standard Bordeaux mixture (8–8–100) frequently involving too much risk of injury to the trees, a formula of 6–9–100 is now recommended for use on Morello cherries, pears, and apples.

DIPPENAAR (B. J.). **Diseases of fruit trees caused by leaf-rust, manganese and zinc deficiencies, and their joint control.**—*S. Afr. J. Sci.*, xxxvii, pp. 136–155, 7 figs., 1941.

The three diseases primarily responsible for the prevalent decline of stone fruit trees in the western Cape Province of recent years are stated to be leaf rust (*Puccinia pruni-spinosae*) [*R.A.M.*, xvi, p. 638], little leaf [ibid., xviii, p. 187], and mottle leaf, the last two associated, respectively, with zinc and manganese deficiency. Mottle leaf was first experimentally identified during the growing season of 1939 to 1940, and shown to be fairly widespread in the Stellenbosch and neighbouring districts. A suspected deficiency of manganese may be identified by the simple expedient of dipping leaves of twigs of actively growing trees in solutions of manganese sulphate (0·25 or 1 per cent.) or the same (1 per cent.) plus 1 per cent. hydrated lime [ibid., xvii, p. 751]. Peach and apricot shoots recover within a fortnight of immersion, while citrus requires a somewhat longer period, the last-named also responding favourably to a mixture of 0·25 per cent. potassium permanganate and 1 per cent. of lime. An even simpler method consists in placing a number of droplets of any of the above-mentioned solutions on the chlorotic areas of the leaves, which will react by the development of the normal green tint against a yellow background. Evidence of manganese deficiency, expressed in the form of mottle leaf, was secured by the means described in Santa Rosa, Kelsey, and Sultan plums, Victoria, Early Rivers, and Gold Mine nectarines, Elberta and Muir peaches, Royal and Cape apricots, Cape lemons, chestnuts, apples, vines, and figs. Among the ornamentals benefiting by manganese applications may be mentioned rose, granadilla (*Passiflora quintensis*), sunflower, and *Bougainvillea*. French beans (*Phaseolus vulgaris*) and potatoes are the only vegetables in which manganese deficiency has been positively demonstrated. The chlorosis which is the principal external symptom of an inadequate manganese supply may be of varying intensity, from a mere trace of pallor in the normal green colour between the lateral veins on either side of the midrib to the involvement of almost the entire leaf surface except for strips of green along the midrib and on

either side of it, as well as on each side of the lateral veins. In cases of intermediate severity the green colour is also retained along the cross veins between the lateral ones, forming chlorotic islands. Marginal scorch, or necrosis of the chlorotic areas, may occur under extremely hot and dry conditions on chestnut, bean, and potato foliage. The only sign of manganese deficiency on fruits so far observed is a severe cracking of Santa Rosa plums, which was effectively combated by the insertion into the stems, five weeks before the onset of maturity, of crystals of manganese sulphate and potassium permanganate, the incidence of the trouble being reduced from between 50 and 60 per cent. on the controls to under 1 per cent.

Little leaf, of equally wide distribution with mottle leaf, is far more destructive, affecting pears and grapefruit in addition to the fruits mentioned above. The disease falls into three phases, of which the first is mottling and chlorosis of the leaves (accompanied in apple and peach by the formation of a purplish pigment in and along the network of cross veins), the second is characterized by extreme reduction in the size of the leaves, especially those originating from the terminal buds of the leaders, while the third is a die-back of the leaders affected in previous seasons. The removal of the dead wood by pruning reduced the diseased trees to inconsiderable proportions within four or five years. *Schizophyllum commune* and other wound parasites accelerate the end of trees brought into a state of debility by little leaf.

*P. pruni-spinosae*, always troublesome on d'Agen prunes, almonds, peaches, and Japanese plums [*Prunus salicina*], has lately caused concern among Wellington growers on account of its attacks on Alpha apricots. Not only do the cumulative effects of rust contribute to the gradual decline of orchard productivity through repeated premature defoliation, but direct infection of the fruit, in the shape of blemishes and cracks, renders it unfit for export and canning.

Little leaf of peaches was experimentally shown to yield much more readily to a late spring treatment with zinc-lime (10–5–100) than to dormant sprays of zinc sulphate only. Plums, on the other hand, derived more benefit from a dormant application of zinc sulphate (50–100). Complete control of mottle leaf in Victoria nectarines, plums, and citrus was obtained by the application in January and February, 1940, of the above-mentioned manganese-containing compounds. Zinc-lime sprays (10–5–100) were equally effective with Bordeaux mixture (4–4–100) against *P. pruni-spinosae*, a mixture of potassium permanganate and lime giving slightly less favourable results.

MAIER (W.). **Stippigkeit und Bormangelkrankheiten bei Äpfeln.** [Bitter pit and boron deficiency diseases among Apples.]—*Gartenbauwiss.*, xv, pp. 427–452, 1941. [Abs. in *Chem. Zbl.*, cxii (i), 17, p. 2305, 1941.]

Statements in the relevant literature regarding the possibility of combating bitter pit of apples by the application of borax or boric acid fertilizers are thought to be attributable partly to inaccurate methods of experimentation, and partly to confusion between bitter pit and a boron deficiency disease, internal cork [*R.A.M.*, xix, p. 604], the

presence of which in Germany, where it was hitherto unknown, is here recorded for the first time.

KEITT (G. W.), CLAYTON (C. N.), & LANGFORD (M. H.). **Experiments with eradicant fungicides for combating Apple scab.**—*Phytopathology*, xxxi, 4, pp. 296–322, 1 diag., 5 graphs, 1941.

In 1936, 1937, and 1938, a small orchard of Wealthy apple trees in Wisconsin was sprayed after harvest and before leaf fall with a mixture consisting of 8 lb. copper sulphate, 2 lb. monocalcium arsenite, 6 lb. zinc arsenite, 3 qt. fish oil, and water to make up to 100 gals. with the object of limiting scab (*Venturia inaequalis*) ascospore production. No summer spray was given. Counts indicated a reduction due to the treatment of 97 to 100 per cent. in the numbers of fertile perithecia of the fungus in the overwintered foliage and a closely corresponding diminution of ascospore infection as compared with the figures obtained in a neighbouring unsprayed orchard. At harvest time in 1937, 1938, and 1939 the treatment was found to have reduced the number of lesions by 96, 91, and 98 per cent., respectively. Wealthy trees sustained no injury from the fungicide, which caused some damage, however, to both lateral and terminal buds of Northwestern Greening and McIntosh.

In 1939 the overwintered leaves on the ground in a six-acre McIntosh orchard in sod were sprayed with elgetol extra [*R.A.M.*, xx, p. 212], 1 per cent. by volume in water, at the rate of 450 gals. per acre, which was found to reduce the ascospore infection by about 96 per cent. Three weeks after petal-fall the scab epidemic on unsprayed trees in the treated orchard was reduced by about nine-tenths as compared with the condition of one left untreated a short distance away, thereby greatly enhancing the efficacy of the summer spray schedules adopted.

The results of these experiments establish for apple scab the principles (*a*) that the amount of primary inoculum is a major factor in determining the time and intensity of epidemic development, and (*b*) that these in their turn exert a decisive influence on the requirements for its control.

BODINE (E. W.) & DURRELL (L. W.). **Host range of Peach-mosaic virus in western Colorado.**—*Phytopathology*, xxxi, 4, pp. 322–333, 3 figs., 1941.

Trees of an unknown almond variety, Montgamet and Smith apricots, Royal Duke cherry, Hungarian prune, and Green Gage, Satsuma, Maynard, Blue Damson, and Wickson plums were inoculated by budding with the peach mosaic virus [*R.A.M.*, xviii, p. 260]. Of these, only the Hungarian prune and Montgamet apricot showed external symptoms of infection, which was proved, however, by means of bud insertions into healthy Elberta peach trees and seedlings, to have been contracted by all the trees inoculated. Grafting a total of 1,340 plum (25 varieties), apricot (three varieties), and almond (one variety) with two healthy Elberta peach scions per tree revealed no case of peach mosaic infection.

Spontaneous mosaic infection has been observed on Montgamet and an unknown variety of apricot, Royal Duke cherry, flowering peach,

Satsuma plum, and Italian prune. In order to ascertain whether these disorders were the outcome of infection by peach mosaic, buds from trees of each affected variety were inserted into healthy Elberta peach trees and seedlings, of which, however, only those inoculated with flowering peach buds developed peach mosaic symptoms. The unknown apricot and Satsuma plum introduced into the peach hosts a distinct mosaic communicable from apricot to plum and vice versa and apparently due to an identical virus. By bud inoculations of the same variety from which the buds were obtained, the virus natures of all the spontaneously occurring mosaics investigated, except those of Italian prune and Montgamet apricot, were demonstrated.

A five-year (1935 to 1939) study of the incidence of peach mosaic in seven orchards showed that the eradication of diseased trees definitely arrested the spread of mosaic in three orchards planted only with the Elberta or J. H. Hale variety or both, whereas in the remaining four occupied by a mixture of several other varieties besides those two, continuous roguing failed to check the progress of the disease.

Grafting Elberta test scions on 200 peach trees of the Carman, Guinn, Salwey, Wonderful, and Victor varieties, selected at random, gave variable results. In many cases where no mosaic symptoms were apparent in the stocks, slight to moderate infection developed in the scions, while in others of slight infection in the stocks, moderate to severe symptoms occurred in the scions. Again, scions growing on mildly affected stocks showed no symptoms, and finally, there were many cases in which mosaic was absent both from stock and scion.

HILDEBRAND (E. M.). **A new case of rosette mosaic on Peach.**—*Phytopathology*, xxxi, 4, pp. 353–355, 2 figs., 1941.

In 1938 a peach tree was observed in Rockland County, New York, to be suffering from a disorder not hitherto observed in the State and apparently identical with Cation's Michigan rosette or rosette mosaic (*Quart. Bull. Mich. agric. Exp. Sta.*, xvi, pp. 79–84, 1933) [cf. *R.A.M.*, xiv, p. 219]. Ten Elberta trees in the greenhouse inoculated with the disease by budding during the late summer developed foliar distortion and chlorosis in the following February, similar symptoms being obtained in infection tests with Michigan budwood. The mosaic symptoms gradually disappeared as the season advanced, but the peculiar wavy habit of growth and rosetting of the foliage and stunting of the trees persisted. Some of the infected trees produced ripe, well flavoured, naphthalene-yellow fruit during the first week of May. The writer (unpublished data) has induced a similar but milder wavy-leaf condition in Elberta peach trees by budding with material from mosaic-diseased prunes [see preceding abstract], suggesting the possibility of a relationship between the prune mosaic and peach rosette mosaic viruses.

KILPATRICK (D. T.). **Manganese deficiency in Peaches.**—*Agric. Gaz. N.S.W.*, lii, 3, pp. 151–152, 1 fig., 1941.

Blackburn peaches growing on a shale type of soil at Wedderburn, New South Wales, have shown symptoms of manganese deficiency, consisting of an intravenous leaf chlorosis, the midrib and veins and the adjoining parts being deep green, while the rest of the leaf is a

lighter, dull hue. The most severely affected leaves are small, and are generally borne on spur extensions and at the bases of laterals. Seen as a whole, the foliage of a badly affected tree is yellowish, while that of a slightly affected tree has a dull, mottled appearance. The condition, which appears to be a limiting factor in both growth and fruit production, was corrected by a winter spray (early July) made at the rate of 1 lb. manganese sulphate per 2 gals. of water.

Serbinoff (V. I.). Пятнистость Абрикосов и борьба с этим заболеванием. [Spotting of Apricots and its control.]—60 pp., 7 figs., 2 diags., Госуд. Издат. Таджикск. ССР. [State Publ. Off. Tadzhik S.S.R.], Stalinabad–Leningrad, 1940.

In studies conducted at the Scientific Research Institute for fruit, vine, and vegetable cultivation in the Tadzhik S.S.R. [Russian Central Asia] from 1935 to 1938, it was found that spotting of apricots often occurs in the absence of *Clasterosporium carpophilum* [*R.A.M.*, viii, p. 319], generally believed to be the causal agent of this disease. Inoculations with cultures of the fungus in the laboratory and field failed to cause infection of apricot fruits, and the few spots produced on the leaves did not resemble those found in nature. Isolates from diseased apricot tissues yielded a bacterium similar to *Bacterium pruni*, and the pathogenicity of this organism was proved in both greenhouse and orchard inoculations, the symptoms produced being identical with those observed on naturally infected trees. It is concluded that the spotting is caused chiefly by this bacterium, though *C. carpophilum* may play some part as well. The disease is stated to attack mainly the fruits under Tadzhik conditions, leaves and stems being affected to a lesser degree. Infection is spread by rain, branches protected by waxed bags showing only 29·4 per cent. fruits, compared with 79·1 per cent. for those protected only by gauze and 92·5 per cent. for the unprotected. It is believed that the inoculum accumulates during the winter in gumming wounds and that in spring the rains dissolve the gum and wash it on to the lower shoots, leaves, and fruits. Observations over many years show that infection occurs five to six days after the first rain following blossoming, but a period with an air humidity of not less than 70 per cent. is essential for infection to take place. Proper care of the orchards and timely removal of dead branches, tend to reduce infection. In tests in 1935 the varieties Mirsandzheli, Khourmai, and Khassak showed on the average 97, 94, and 91 per cent. spotted fruits, respectively, the corresponding figures in 1937 being 81, 54, and 28 per cent. Of these varieties the first-named is the sweetest, and according to results obtained by other workers the sweeter varieties are the more susceptible [loc. cit.].

In Russian Central Asia, and in particular in the Tadzhik S.S.R., widespread infection of apricot trees occurs every year. Data obtained from typical orchards showed that the spotting caused a reduction of 27·57 per cent. in the weight of the fruit, the average loss due to the trouble being calculated as 13·58 per cent. of the whole crop of a given tree. The disease also causes a decrease in the sugar content of the fruit and generally reduces the commercial grade.

None of the fungicides tested gave complete control of spotting, but

in 1937 trials two applications of 1 per cent. Bordeaux mixture, the first after blossoming and the second 15 days later, reduced the percentage of diseased fruit harvested from 91·9 in the untreated control to 78·3, the corresponding percentage for lime with sulphur (ground sulphur 1 to 1·5 parts, quicklime 1 to 1·5 parts, and water 100 parts) being 80·8.

HILDEBRAND (E. M.) & MILLS (W. D.). **Cherry yellows (physiological yellow leaf) in New York.**—*Phytopathology*, xxxi, 4, pp. 355–356, 1941.

Plant disease survey records at Cornell, New York State, reveal the presence of the so-called physiological yellow leaf of cherry [*R.A.M.*, xix, p. 30] every year since 1928, with heavy resultant defoliation in that year, 1931, 1935, 1937, and 1938, the date of the earliest appearance of the trouble ranging from 16th June to 6th July, and termination for the season usually occurring by 15th July. In Michigan and Wisconsin the symptoms of the disease and defoliation periods agree closely with those observed in New York, and there appears to be little doubt that the bud-transmissible cherry yellows virus is concerned in all the affected localities, though the character of the injuries sustained is somewhat milder in New York than in the more rigorous climate of Wisconsin.

HILDEBRAND (E. M.). **Cane gall of Brambles caused by Phytomonas rubi n.sp.**—*J. agric. Res.*, lxi, 9, pp. 685–696, 3 figs., 1940.

A study carried out in New York during the past seven years on cane gall of *Rubus* spp. [cf. *R.A.M.*, xv, p. 304] showed that the symptoms appear on the fruiting canes in May or June as small protuberances or elongate ridges of white granular gall tissue. The whitish eruptions rapidly increase in size and number and may entirely cover parts of the cane surface; they are most numerous on the lower part, but occur on the upper part, and on the small terminal branches. After some weeks the gall tissue turns brown, and starts to disintegrate near the soil surface. The enlargement of the galls often causes the stems to split open and the canes to dry out, canes so affected giving only small, seedy berries.

Inoculation with the organism isolated from the galls into fruiting canes, current-season cane growth and petioles, and roots readily induced gall formation. Small galls developed on the roots when the organism was introduced into the soil either directly or by means of water washing the organism off galls above the ground. Cultural, physiological, and morphological studies showed the causal organism, which is named *Phytomonas rubi* n.sp. (*Bacterium rubi* or *Pseudomonas rubi* according to other classifications), to be a Gram-negative, non-acid-fast rod, 1·7 by 0·6 $\mu$, with rounded ends, mostly occurring singly or in pairs, occasionally in short chains in culture, and in chains and masses only in host tissue. It is a weak facultative anaerobe with optimum growth at 27° C.; the thermal death point is about 56°. It is motile by subpolar flagella, and does not form spores. It does not liquefy gelatine, hydrolyse starch, reduce nitrates, or produce hydrogen sulphide or indol, but produces acid in milk, acid but no apparent gas

from arabinose, xylose, rhamnose, fructose, mannose, galactose, glucose, lactose, and erythritol; alkali but no apparent gas from melezitose, starch, inulin, pectin, lactositol, calcium gluconate, and formic, acetic, propionic, glycollic, malonic, succinic, tartaric, and malic acids, and yeast extract.

In New York the condition was observed in commercial plantings on black and purple raspberries [*Rubus occidentalis* and *R. neglectus*] and blackberries, and these hosts and raspberries were also successfully inoculated.

The disease is at present only of small importance and control measures for crown gall (*P.* [*Bacterium*] *tumefaciens*) are also effective against cane gall. The organism is apparently less able to survive in the soil than is *Bact. tumefaciens*.

McKnight (T.). **Water blister disease of Pineapples.**—*Qd agric. J.*, lv, 3, pp. 180–182, 1941.

The author states that from the first week in January until the last week in April, 1940, reports were received in Queensland recording losses due to water blister [*Ceratostomella paradoxa*: *R.A.M.*, p. 460] in consignments of pineapples received in southern markets. Visits to 43 growers demonstrated conclusively that incidence is correlated with picking and packing-shed conditions, and that where the official control recommendations are carefully carried out the disease does not occur.

The factors governing incidence are the presence of pineapple refuse in and near the packing shed; the presence of handling wounds and growth cracks; delay in marketing; weather conditions before picking (warm, wet weather favouring the fungus, or wet following dry weather inducing cracks); temperature and humidity during transport; and injuries sustained after packing. February and March are the peak periods for losses, but growers should not relax their precautions between late December and the end of April. Control depends on observing the following recommendations: strict hygiene in and round the packing shed, and complete disinfection of the shed when warranted with 2 to 5 per cent. formalin solution; care in picking and handling; packing on the headlands when weather permits; avoiding the packing of fruit while still wet; avoiding transport delays; rigorous exclusion of all sunburnt or injured fruits; spraying all second-hand cases suspected of being contaminated with 2 per cent. formalin solution; and dusting the stem ends before packing with a mixture of one part benzoic acid and four parts kaolin, an additional precaution particularly recommended when weather conditions favour the disease. Experimental evidence failed to support the view (held by some growers) that fruits receiving heavy nitrogen applications are more susceptible than those given light ones.

Ramsbottom (J.). **Presidential address. The expanding knowledge of mycology since Linnaeus.**—*Proc. Linn. Soc. Lond.*, *1938–9*, pp. 280–367, 1941.

In his presidential address delivered to the Linnean Society of London held on 24th May, 1939, the author traced the gradual develop-

ment of ideas concerning the nature of fungi beginning with ancient Rome to recent times, with particular emphasis on the work of Linnaeus.

Hopkins (J. C. F.). **Economic and domestic implications of plant diseases in Southern Rhodesia.**—*S. Afr. J. Sci.*, xxxvii, pp. 46–57, 1941.

The author discusses the effects on the economic system and domestic life of Southern Rhodesia of the principal diseases affecting crops of major importance in the Colony, namely, tobacco, maize, small cereals, fruit, and vegetables, with special reference to the first-named. It is contended that plant disease control should not be considered merely in the light of a specialized problem concerned exclusively with financial profit and loss, but as a vital factor in the production of the foodstuffs essential for the maintenance of physical fitness in individuals and efficiency in the nation as a whole.

Hausam (W.) & Liebscher (E.). **Über Fleckenbildungen auf lohgarem Schafleder durch Mikroorganismen.** [On the spotting of tanned sheep's leather by micro-organisms.]—*Collegium, Haltingen, 1940*, pp. 506–508, 1940. [Abs. in *Chem. Zbl.*, cxii (i), 16, p. 2210, 1941.]

The presence on sheep's leathers treated with various synthetic tanning preparations and quebracho of grey- to brownish-purple spots or blotches was shown by further investigations at the Kaiser Wilhelm Institute for Leather Research, Dresden, to be due to *Dematium* [*R.A.M.*, xvi, p. 179], *Paecilomyces*, and probably a variety of other species of fungi. Figures are given of the damaged leathers and the mycelium and fructifications of the fungi concerned.

W. (C. M.). **Brown stains on the leaves of a stamp album.**—*Patra J.*, iii, 6, pp. 252–253, 1940. [Abs. in *Bull. Inst. Pap. Chem.*, xi, 6, p. 131, 1941.]

The appearance of the brown spots developing on the pages of a stamp album during storage suggested that they were due to 'foxing', a defect caused by mould growth associated in some way with the presence of iron [*R.A.M.*, xix, p. 635]. Microscopic examination confirmed this diagnosis, revealing both mould spores and iron, of which slightly more was detected in the spotted than in the clean areas of the paper. 'Foxing' can usually be removed by the treatment of the paper with a bleaching agent, e.g., sodium hypochlorite, but care is necessary to avoid deleterious effects. Liability to the defect may be minimized by the use of iron-free paper and storage in a dry place.

Rhea (H. E.). **The new electron microscope.**—*Science*, N.S., xciii, 2415, pp. 357–358, 1941.

A description is given of the new electron microscope now being manufactured by the RCA Manufacturing Company, Inc., which is capable of magnifications of 100,000 and affords a means not only of observing but also of photographing even some of the previously invisible filterable viruses.

D'Oliveira (Maria de L.). **Os virus como parasitas.** [The viruses as parasites.]—*Rev. agron., Lisboa*, xxviii, 2, pp. 188–200, 1940.

This is a survey of some recent outstanding developments in the study of parasitic plant viruses, reference to most of which has already been made in this *Review*.

D'Angremond (A.) & van Hell (W. F.). **Mycorrhiza van Hevea brasiliensis Müll.-Arg.** [Mycorrhiza of *Hevea brasiliensis* Müll.-Arg.]—Reprinted from *Versl. Ver. Proefst.-Personeel, Medan-Sumatra, 1939*, 16 pp., 6 figs., 1939. [English summary. Received June, 1941.]

Following a survey of outstanding contributions to the literature on mycorrhiza, a description is given of a typical endotrophic fungus occurring almost exclusively in the cortical tissues of the short, thick, yellowish-brown rootlets of *Hevea* rubber in the Dutch East Indies; entry being effected through the youngest tips, the root caps, root hairs, or even by way of the old epidermal cells. The hyphae are both intra- and intercellular, the former non-septate, swollen, multinuclear, and provided with vesicles and arbuscules [cf. *R.A.M.*, xviii, p. 469], and the latter septate, long, slender, and forming vesicles. Mycelial clumps develop in the cells during digestion. The organism resembles *Macrophomina phaseoli* [ibid., ix, p. 127], but its exact identity has not yet been demonstrated.

Ark (P. A.) & Hunt (Marjorie L.). **Saprophytes antagonistic to phytopathogenic and other micro-organisms.**—*Science*, N.S., xciii, 2415, pp. 354–355, 1941.

A number of bacterial species antagonistic to phytopathogenic micro-organisms were isolated from soil, of which two, *Bacillus vulgatus* and one as yet unidentified yellow, spore-bearing bacillus, were studied in culture. The two antagonists were active against *Erwinia amylovora*, *E. aroideae*, *E. carotovora*, *E. phytophthora*, *Phytomonas* [*Pseudomonas*] *campestris*, *P.* [*Bacterium*] *flaccumfaciens*, *P. insidiosa* [*Aplanobacter insidiosum*], *P.* [*Bact.*] *juglandis*, *P.* [*Bact.*] *lacrymans*, *P.* [*Bact.*] *malvacearum*, *P. michiganensis* [*A. michiganense*], *P.* [*Bact.*] *panici*, *P.* [*Bact.*] *pisi*, *P. sepedonica* [*Bact. sepedonicum*], *P.* [*A.*] *stewarti*, *P.* [*Bact.*] *tumefaciens*, *Fusarium graminearum* [*Gibberella saubinetii*], *F.* [*bulbigenum* var.] *lycopersici*, *Dematophora* [*Rosellinia*] *necatrix*, *Helminthosporium sativum*, *Verticillium albo-atrum*, and *Phytophthora* sp., as well as several non-pathogenic organisms. The bactericidal substances produced by the two species were water-soluble and active in extremely small quantities; that of *B. vulgatus* was adsorbed by all Berkefeld filters but passed through a Chamberland L 3, while that of the yellow bacillus was retained by both types of filter; neither was destroyed by boiling for 60 minutes. In the autoclave, the bactericide of the yellow bacillus was inactivated after 15 minutes at 10 lb. pressure, while that of *B. vulgatus* was still active after 10 minutes at 20 lb. pressure. The strongest antagonism was displayed in media containing dextrose and fructose, while none was observed on a peptone sugar-free medium or in a nutrient medium plus maltose. All attempts to precipitate the active principle from cultural solutions were unsuccessful,

but it was possible to concentrate the bactericidal material by evaporating the culture media to dryness in a double boiler. Further studies on this phase of the work are in progress.

W. (L. G. G.). **Cracking of Potato tubers.**—*Gdnrs' Chron.*, Ser. 3, cix, 2841, p. 223, 1941.

The writer has observed cracking in large Ally and Majestic potato tubers within 24 hours of lifting, the crop being dug before the attainment of full maturity and during a late summer drought [cf. *R.A.M.*, xv, p. 820]. Such tubers, on exposure to the dry air, presumably lose water from their superficial tissues at such a rate as to disturb the equilibrium between the central and outer tissues, the tension in the peripheral zones resulting from stretching by the turgid inner region being relieved by the development of fissures.

Jehle (R. A.). **Potato disease control studies on the Maryland Eastern Shore.**—*Bull. Md agric. Exp. Sta.* 443, pp. 273–316, 6 figs., 1940.

In a comprehensive series of investigations on the control of the potato diseases prevalent in the Eastern Shore region of Maryland, the following results were obtained.

No significant difference was found in the percentage incidence of virus diseases in plots grown from seed stocks maintained at different storage temperatures. Renewal of the seed stock at least every other year, or, better, every year, is necessary for the production of good late-grown Irish Cobbler Eastern Shore seed stock. Only registered seed or certified seed grown in fields practically unaffected by virus diseases is safe for the renewal of late Eastern Shore-grown seed stock.

Tubers from the early Eastern Shore crop can be used for planting the late seed crop if the cut tubers are soaked for one hour in a solution of sodium thiocyanate (1 lb. to 12 gals. of water) and planted at once. Repetition of the treatment for two successive years, however, greatly increased the percentage of leaf roll in Warba seed stock in spite of roguing. Virus disease control would be a matter of some difficulty if the practice of growing late seed crops from treated, spring-grown seed became general locally.

All local growers are advised to spray the vines, for the control of early blight [*Alternaria solani*], flea beetles, and leafhoppers, with Bordeaux mixture (4–4–50) plus 2 lb. calcium arsenate per 50 gals., beginning when the plants are 6 in. high or less, repeating about two weeks later, and following with applications at seven- to ten-day intervals until the vines are mature. If spraying is impracticable, dusting with monohydrated copper-lime dust may be substituted.

Parris (G. K.) & Jones (W. W.). **Studies on the nature of spindling sprout of Potato.**—*Phytopathology*, xxxi, 4, pp. 340–346, 1 fig., 1941.

Investigations were undertaken to determine the nature of spindling or hair sprout of potato [*R.A.M.*, xvii, p. 700], which was present to an appreciable extent in consignments of Bliss Triumph tubers imported into Hawaii from North Dakota and elsewhere in the United

States during the autumn of 1937. The condition in question is herein defined as 'the premature production of thread-like sprouts by tubers'.

The disease is not transmissible by grafting. The grafting of normal tubers with cores from affected ones results in a stimulation of the eyes of the former with consequent production of an abnormally large number of healthy stems. Eyes from sound tubers grafted into diseased ones produce shoots of normal foliar and stem habit. The following were the numbers of sprouts per plant and yield in lbs. per 50 plants of (1) normal tubers, (2) the same grafted with spindling-sprout cores (graft A), (3) spindling-sprout tubers grafted with normal cores (graft B), and (4) spindling-sprout tubers: (1) $2{\cdot}36 \pm 0{\cdot}24$ and $33{\cdot}7 \pm 3{\cdot}8$, respectively; (2) $4{\cdot}60 \pm 0{\cdot}24$ and $41{\cdot}2 \pm 3{\cdot}8$, respectively; (3) $6{\cdot}15 \pm 0{\cdot}38$ and $12{\cdot}8 \pm 4{\cdot}4$, respectively; and (4) $13{\cdot}78 \pm 0{\cdot}35$ and $8{\cdot}9 \pm 5{\cdot}4$, respectively. The difference in yield between (1) and (2) and that between (3) and (4) are not statistically significant, but there was a significant reduction in yield due to spindling sprout. Of the hills developed from graft A, 93·4 per cent. produced normal tubers, 4·6 per cent. the same but prematurely sprouted, and 2 per cent. under-sized (but not 'spindly'), precociously sprouted tubers. A test indicated that it may be possible to eliminate spindling sprout from an affected population by the selection at harvesting of non-sprouted tubers over $\frac{1}{2}$ in. in diameter.

Chemical analyses of diseased and healthy tubers from the same bag of seed revealed in the former higher concentrations of reducing sugar, sucrose, acid-hydrolysable substances, soluble nitrogen, ammonia, and amino nitrogen than in the latter, the differences between the two lots in regard to the first two fractions being of possible significance. Spindling sprout may be related to an inability of the apical meristems of the buds of a tuber to synthesize proteins.

Holmberg (C.). **Potatiskräftans bekämpande och Potatissortfrågan. 1. Potatiskräftans utbredning och statliga åtgärder.** [Potato wart control and the question of Potato varieties. 1. Potato wart distribution and State precautions.]—*Landtmannen, Uppsala*, xxv, 8, pp. 149–150, 1 fig., 1 map, 1941.

The present situation as regards the geographical distribution of potato wart [*Synchytrium endobioticum*] in Sweden and the measures enforced by the State for its control are summarized [*R.A.M.*, xiv, pp. 672, 787; xv, p. 608]. Blekinge and Halland are the two provinces containing the maximum number of infection foci, 271 being counted in the former and 241 in the latter from 1928 to 1936 and the following additions being made in 1937, 1938, 1939, and 1940; Blekinge 18, 13, 21, and 3, respectively; Halland 6, 9, 17, and 1, respectively. For the entire country the numbers of new cases detected in 1936, 1937, 1938, 1939, and 1940 were 179, 90, 103, 77, and 107, respectively. The infected areas are under the supervision of the Plant Protection Institute, inspections being made as a rule every summer. Owing to the longevity of the resting spores of *S. endobioticum*, the viability of which extends over a minimum period of 15 years in the soil, the restrictions relating to such areas must necessarily be maintained until all risk of a recrudescence of the disease is at an end. Some details are given of

the mode of dissemination of the fungus by commerce in diseased stocks, use of contaminated implements and the like, and omission to notify fresh cases. [An account by the same author of the distribution of potato wart disease in Sweden also appears in *Växtskyddsnotiser, Växtskyddanst., Stockh., 1941*, 2, pp. 23–27, 1 map, 1941.]

**Potato blight. What have we to expect, and what are we going to do about it in 1941?**—4 pp., 1 diag., issued by Seale-Hayne Agricultural College, Newton Abbot, Devon, [1941].

In this useful leaflet simple directions are given to growers on the control of potato blight [*Phytophthora infestans*] by spraying and dusting. The disease is estimated to produce in Devon and Cornwall an average loss of two tons of ware per acre, which could be almost completely prevented by spraying.

Lehmann (H.). **Untersuchungen über die Genetik und Physiologie der Resistenz der Kartoffel gegen Phytophthora infestans de Bary. Die genetische Analyse der Resistenz von Solanum demissum sp. (vorl. Mitteilung).** [Studies on the genetics and physiology of the resistance of the Potato to *Phytophthora infestans* de Bary. The genetic analysis of the resistance of *Solanum demissum* sp. (preliminary note).]—*Züchter*, xiii, 2, pp. 33–34, 1 fig., 1941.

In potato-breeding investigations at the Kaiser Wilhelm Plant Breeding Institute, Müncheberg, Mark, the author used as parents nine forms of *Solanum demissum*, selected as homozygous for complete resistance or susceptibility to potato blight (*Phytophthora infestans*) [*R.A.M.*, xvii, p. 765], all lines showing intermediate or graduated reaction being rejected. The reactions of these forms were as follows: *S. demissum* El Desierto, resistant to races 8 and 5 of the fungus, *S. d. tlaxpehualcoense*, resistant to both races, *S. d.* Redd. v. Pr., *S. d. utile*, and *S. d.* Buk. 029 all susceptible to 8, resistant to 5, *S. d. xitlense*, *S. d.* Redd. 519, *S. d.* Buk., and *S. d.* Rio Frio, the four last-named susceptible to both races of *P. infestans*. The $F_1$ plants arising from all crosses, involving 16 different combinations (nine reciprocal) were uniformly resistant. In the $F_1$ segregation took place on a 3 : 1 basis, in back-crosses of the $F_1$ with the resistant parent the $F_1$ seedlings proved uniformly resistant, while in similar crosses with the susceptible parent the progeny segregated in a ratio of 1 : 1. The total number of seedlings analysed was about 23,000, comprising 2,000 parents and 3,500, 11,500, and 6,000 of the $F_1$, $F_2$, and $F_2'$ generations, respectively. On the basis of these data it may be confidently asserted that the resistance of the 72-chromosome *S. demissum* to late blight is inherited in a dominant manner and rests on a single Mendelian gene, the mode of transmission being identical in respect of both races of the fungus used in the tests.

Hawkes (J. G.). **Potato-collecting expeditions in Mexico and S. America.**—30 pp., 1 fig., 4 graphs, 2 maps, Cambridge, Imp. Bur. Pl. Breed., 1941. 3*s*. 0*d*.

An interesting account is given of the expeditions organized by the Imperial Agricultural Bureaux for the purpose of collecting indigenous

wild and cultivated potatoes in Mexico and South America in 1938–9 under the leadership of E. K. Balls. One of the most important objects of the survey was the collection of disease-resistant types, and tests still in progress with the material collected indicate that quite a high proportion of the Mexican species are highly resistant to, or immune from, late blight (*Phytophthora infestans*) [*R.A.M.*, xx, p. 130] in the laboratory. For the first time absolute immunity has been found in a very prolific diploid species, *Solanum lanciforme*, which is far superior in this respect to the two tetraploids *S. antipoviczii* and *S. ajuscoense*. So far, none of the South American material has given evidence of resistance to late blight.

According to Bukasoff, the Russian geneticist who paid several visits to Mexico and South America of recent years, resistance to wart disease (*Synchytrium endobioticum*) is fairly common among potato varieties from the latter region, but at present only a small proportion of the material from the Empire expedition has been tested from this point of view.

Bukasoff further maintains that *S. rybinii*, a diploid Colombian species, possesses a high degree of resistance to virus diseases, and more than 30 samples of diploid types related to this species and *S. boyacense* are now available for study.

BOTTOMLEY (A[VERIL] M.). **Potato-tuber diseases: common scab and Rhizoctonia.**—*Fmg S. Afr.*, xvi, 181, p. 141, 1941.

Potato scab (*Actinomyces scabies*) and *Rhizoctonia* disease (*R.* [*Corticium*] *solani*) are both very prevalent in South Africa, and as seed potatoes are likely to be scarce during the coming season, it is possible that some diseased seed may be planted. Growers are, accordingly, strongly advised to disinfect all tubers showing even a trace of infection. The method recommended is to place the uncut potatoes in boxes, dip them in water, drain them, keep them moist for 12 to 24 hours, then dip them for two hours in mercuric chloride solution (4 oz. per 30 gals.) drying immediately. Treatment should be effected before the tubers have sprouted and at least two weeks before planting. The solution may be used three times only for lots up to 60 lb. With lots up to 4 bush. ½ oz. of mercuric chloride and sufficient water to restore the solution to its original volume may be added after each treatment up to eight.

VALLEAU (W. D.). **Powdery mildew of Potato in Kentucky.**—*Phytopathology*, xxxi, 4, pp. 357–358, 1941.

The older shoots of seedling potato plants at the Kentucky Agricultural Experiment Station were observed in the autumn of 1940 to bear powdery masses of conidia, 25·5 to 38·2 by 10·9 to 18·2 (average 32·8 by 13·8) $\mu$, which were succeeded before the death of the foliage by dark brown perithecia, 127 to 136 $\mu$ in diameter, furnished with indeterminate hypha-like appendages, and containing predominantly bisporulate, stalked asci, 54·5 to 72·7 by 25·5 to 36·4 (59·1 by 31·4) $\mu$, the ascospores measuring 16·4 to 27·3 by 10·9 to 20 (21·3 by 13·8) $\mu$. The fungus was tentatively identified as *Erysiphe cichoracearum* [*R.A.M.*, xv, p. 604] by the writer, and J. A. Stevenson also assigned the fungus to this species.

TULLIS (E. C.) & CRALLEY (E. M.). **Longevity of sclerotia of the stem-rot fungus Leptosphaeria salvinii.**—*Phytopathology*, xxxi, 3, pp. 279–281, 1941.

The sclerotia of the rice stem rot fungus, *Leptosphaeria salvinii*, were found to remain viable in uncultivated rice soil in Arkansas for at least six years [*R.A.M.*, xiii, p. 395; xvii, p. 128; xviii, p. 815]. Sclerotia recovered from stubble (*a*) in the field and (*b*) stored in the laboratory were still viable after 2 and 2½ years, respectively. It is apparent, therefore, that the disease cannot be eliminated by rotation periods of four to six years.

ORIAN (G.). **Hosts of the Sugar Cane gumming disease organism.**—*Rev. agric. Maurice*, xx, 1, pp. 19–58, 7 pl., 1941. [French summary.]

Most of the information in this comprehensive survey of the natural and artificial host range of the agent of gumming disease of sugar-cane (*Bacterium vasculorum*) in Mauritius has already been summarized [*R.A.M.*, xviii, p. 374], but coco-nut should be added to the list of plants reacting positively to inoculation with the pathogen, and the giant bamboo, erroneously designated *Dendrocalamus giganteus* in a previous paper, is herein identified as *Bambusa vulgaris*. Certain slight differences in the morphological and cultural characters of the organism isolated from *Thysanolaena maxima* [*T. agrostis* Nees] indicate that it belongs to a strain distinct from those of sugar-cane, *Dictyosperma album*, and probably also of maize. The dimensions of the rods from sugar-cane, *D. album*, and *T. agrostis* are given as 1·4 by 0·5 $\mu$, 1·3 by 0·45 $\mu$, and 1·2 by 0·5 $\mu$, respectively.

ZEROVA (Mme M. Y.). Декілька нових для СССР видів **Phomopsis.** [Some species of *Phomopsis* new to the U.S.S.R.]—*J. Bot. Acad. Sci. Ukr.*, i, 2, pp. 305–309, 1940. [English summary.]

Descriptions are given of 12 species of *Phomopsis* new to the U.S.S.R., including five new to science [with Latin diagnoses of the latter], of which the following may be mentioned: *P.* [*Diaporthe*] *perniciosa* on peach, *P. perseae* n.sp. on avocado, and *P. diospyri* n.sp. on *Diospyros lotus*.

PILÁT (A.). **Revision der Gattung Lentinus Fr. aus dem Herbar des Naturhistoriska Riksmuseet in Stockholm.** [A revision of the genus *Lentinus* Fr. from the herbarium of the State Natural History Museum in Stockholm.]—*Ann. mycol., Berl.*, xxxix, 1, pp. 71–103, 1941.

A critically annotated list is given of 106 species of *Lentinus* represented in the herbarium of the Stockholm Natural History Museum, including one new one, *L. samarensis* [with a Latin diagnosis], on wood in the Philippines, and six new varieties. Three recently described genera, viz., *Lentinopanus* Pilát 1935 = *Panus* (Fr.) emend. Singer 1936, *Lentinellus* (Karst.) emend. Kühner 1934, and *Lentinaria* Pilát 1940, between them accommodate the species formerly assigned to *Lentinus* but now excluded from the genus in its amended form.

UNAMUNO (L. M.). **Notas micológicas. XIV. Contribución al estudio de los Uredinales y Ustilaginales de la flora española.** [Mycological notes. XIV. A contribution to the study of the Uredinales and Ustilaginales of the Spanish flora.]—*Bol. Soc. esp. Hist. nat.*, xxxviii (*1940*), pp. 19–36, 5 figs., 1941.

In this further instalment of the author's geographical and taxonomic studies on the Spanish mycoflora [*R.A.M.*, xvii, p. 415] are enumerated 41 rusts and 13 smuts, the former including two new species (*Puccinia ateridoi* on *Dianthus toletanus* and *P. rodriguezii* on *Aster acris* var. *glutinosa*), *P. menthae* on *Mentha longifolia* [ibid., xvii, pp. 485, 771; xix, p. 730], *Uromyces betae* on beet, and *Gymnosporangium sabinae* [ibid., xx, p. 24] on pear, and the latter *Ustilago cynodontis* on *Cynodon dactylon*, *U. zeae* on maize, and *Tilletia foetens* [*T. foetida*] and *T. tritici* [*T. caries*] on wheat.

BONDARTZEFF (A.) & SINGER (R.). **Zur Systematik der Polyporaceen.** [A contribution to the systematics of the Polyporaceae.]—*Ann. mycol., Berl.*, xxxix, 1, pp. 43–65, 1941.

In this paper the authors present their classification of the Polyporaceae sensu lat. They apply to the group the principles previously adopted in Singer's 'Das System der Agaricales', and accordingly give full weight to characters derived from micro-anatomy and cell-chemistry. The diagnoses of the new genera, here given by name only, are expected to appear shortly in *Sovetsk. Bot.*

WINDISCH (S.). **Entwicklungsgeschichtliche Untersuchungen an Torulopsis pulcherrima (Lindner) Saccardo und Candida tropicalis (Castellani) Berkhout. Ein Beitrag zur Systematik der Gärungsmonilien.** [Phylogenetic studies on *Torulopsis pulcherrima* (Lindner) Saccardo and *Candida tropicalis* (Castellani) Berkhout. A contribution to the taxonomy of the fermentation Moniliae.]—*Arch. Mikrobiol.*, xi, 4, pp. 368–390, 6 figs., 1940.

Ascus formation was observed in the strains of *Torulopsis pulcherrima* isolated in pure culture by the writer [? in Germany] from pressed yeast, cherries, and gooseberries [*R.A.M.*, xviii, p. 259] and of *Candida tropicalis* [ibid., xx, p. 258] from the first-named substratum. In both species the asci are developed from bud-like mother cells and contain four spores, uniformly averaging 3 by 2 $\mu$. The ascogenous stages of the two yeasts developed best in Winge-Ranvier chambers (*C.R. Lab. Carlsberg*, Sér. physiol., xxi, p. 77, 1935) or covered concave slides sealed with vaseline. Sporulation occurred in profusion on all the solid and liquid media used, but the membrane enveloping the spores tends to obscure the process. The ascospores do not germinate by means of a hypha, but immediately give rise by budding to small daughter cells, which in *C. tropicalis* develop by unknown means into larger binucleate vegetative cells. In *T. pulcherrima* the fusion of the ascospore daughter cells was observed, the smaller of the two merging into the larger and in turn giving rise to a daughter cell, constituting the first blastospore or point of departure for all further vegetative forms, among which chlamydospores soon become differentiated. These may multiply by

blastospore budding or form asci which either remain sessile or become detached, in either case producing four spores; the former tendency predominated in, but was not confined to, solid media.

All the vegetative forms, as well as the ascus mother cells, were shown by the Winge-Feulgen staining technique to be binucleate, a character which, taken in conjunction with the ascospore budding, suggests far-reaching analogies with the Exoasceae. On the basis of these researches the author proposes to (*a*) incorporate *T. pulcherrima* in the genus *Candida* as *C. pulcherrima*, and (*b*) to unite all candidoid fungi of similar development in the new family of Candidaceae, to be interpolated in the order Exoascales.

Bond (T. E. T.). **Potash deficiency in Tea cultivation.**—*Tea Quart.*, xiii, 4, pp. 139–145, 1940.

This is a review of the recent paper by de Haan and Schoorel on potash deficiency in the tea plantations of Java and Sumatra, already noticed from the original source [*R.A.M.*, xx, p. 83], with an addendum by T. Eden (pp. 146–147) stating that the situation in Ceylon in this respect is much less critical, nine years' omission of potash from the fertilizer having neither diminished the flush or wood yield nor reduced (over a six-year period) the foliar diagnosis figure to the deficiency level.

Bawden (F. C.). **The serological reactions of viruses causing Tobacco necrosis.**—*Brit. J. exp. Path.*, xxii, 2, pp. 59–70, 1 fig., 1941.

The serological studies on tobacco necrosis herein described were conducted at the Rothamsted Experimental Station, for the most part with two stocks, one originally supplied by K. M. Smith in 1936 and since maintained at Rothamsted, and the second (also furnished by K. M. Smith) directly descended from that used by Pirie *et al.* in 1938 [*R.A.M.*, xviii, p. 416], which are referred to as the Rothamsted and Cambridge cultures, respectively. Both the cultures produced apparently identical symptoms on White Burley tobacco and Canadian Wonder French beans (*Phaseolus vulgaris*), but when rubbed on opposite halves of the same leaves the Rothamsted inoculum caused the formation of rather more lesions than the Cambridge material on beans and somewhat fewer on tobacco.

Evidence is presented to show that tobacco necrosis is a disease that can be caused by a number of serologically unrelated viruses, which possess similar physical properties. This is the first record of viruses with no common antigen being able to cause identical symptoms in plants, although the phenomenon was known among animal viruses. From a few tests it appears that most naturally occurring tobacco necrosis is caused by virus mixtures. It is suggested that these viruses are composed of particles of different sizes, and that they may differ in stability. The effects of heating, ageing, and alkali treatment on tobacco necrosis appear to involve intramolecular changes in the virus particles, whereas in the case of potato virus X the particles tend to undergo disruption under the influence of such treatments.

KINCAID (R. C.). **A copper-soap spray for control of Tobacco downy mildew.**—*Phytopathology*, xxxi, 3, pp. 286–288, 2 figs., 1941.

Excellent control of tobacco downy mildew (*Peronospora tabacina*) on transplants in the field is stated to have been obtained in Florida by the application at three-day intervals from 4th to 16th May at the rate of 50 gals. per acre of half-strength flordo (a copper sulphate-soap mixture normally used at the full strength of $3\frac{1}{2}$ lb. to 14 lb. soap per 100 gals.) [*R.A.M.*, xvii, p. 51]. On sprayed leaves water spread into a thin, quickly drying film and this would reduce the likelihood of infection by the fungus.

VAN KOOT (Y.). **Virusreinigung und ihre Lehren über die Art des Virus.** [Virus purification and its teaching concerning the nature of the virus.]—*Tijdschr. PlZiekt.*, xlvi, pp. 97–126, 1940. [Dutch. Abs. in *Chem. Zbl.*, cxii (1), 18, p. 2399, 1941.]

The following methods of purification were applied to tobacco mosaic and single virus streak of tomato at the Wageningen Mycological Laboratory: (1) Stanley's filtration through celite and separation of the virus by repeated precipitation with ammonium sulphate [*R.A.M.*, xiv, p. 721; xv, p. 177, *et passim*]; (2) Bawden and Pirie's heating to 70° C. and separation of the virus after chemical treatment [ibid., xvii, p. 564]; and (3) Ryjkoff's and Gromyko's elimination of the pigments by means of animal charcoal [ibid., xviii, p. 415]. A rapid chemical method for the purification of relatively pigment-free juice consists in filtration through celite, virus precipitation with 40 per cent. ammonium sulphate, and only one treatment with 1 or 2 per cent. charcoal, all at $P_H$ 7. The needles of the tomato single virus streak are slightly shorter (15 $\mu$) than those of tobacco mosaic (20 to 25 $\mu$). The virulence of the tomato virus, as measured by local lesions on *Nicotiana glutinosa*, remained intact during a protracted process of chemical purification, whereas that of tobacco mosaic declined appreciably.

MAY (C.), WALTER (J. M.), & MOOK (P. V.). **Rosy canker of London Plane associated with illuminating gas injury.**—*Phytopathology*, xxxi, 4, pp. 349–351, 1 fig., 1941.

Since 1939 London plane [*Platanus acerifolia*] trees in Maryland, New York, and New Jersey have been observed to bear on the branches and trunks irregular, mostly elongated cankers of a very striking appearance, their furrowed, hypertrophied, more or less decorticated centres being composed of rosy to brown proliferated tissues, up to $\frac{1}{2}$ in. thick, the consistency being reminiscent of the flesh of a watermelon in the early stages, subsequently turning hard and brown. The top of the stump of one severely cankered tree showed brownish-pink spots in the wood of a few of the outer annual increments and scattered, diffuse pink spots nearer the centre. Some branches 1 in. in diameter showed a pale pink discoloration of the inner bark and of the cambial region 20 ft. from the nearest recognizable canker. Platings from the diseased tissues and discoloured wood have yielded no micro-organisms, and the cankers are believed to be a response to the escape of illuminating gas into the soil near the trees.

IMPERIAL MYCOLOGICAL INSTITUTE

# REVIEW OF APPLIED MYCOLOGY

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Foster (A. C.) & Tatman (E. C.). **Effect of certain fungicides and environmental factors on the rate of transpiration of Tomato plants.**—*J. agric. Res.*, lxi, 10, pp. 721–735, 2 figs., 1940.

In greenhouse experiments conducted during 1933–4 at the Arlington Experiment Farm, Virginia, the effect of copper phosphate-bentonite-lime mixture, zinc sulphate-lime, and Bordeaux mixture on the rate of transpiration of maturing tomato plants was studied. The two last-named sprays had no significant effect on the rate of transpiration, but copper phosphate-bentonite-lime caused a highly significant increase regardless of various environmental factors, indicating that these do not influence the effect of the sprays on transpiration. The rate of transpiration was markedly reduced by added increment of soil nitrogen, reduced soil moisture, and reduced air temperature.

Wellman (F. L.). **Epinasty of Tomato, one of the earliest symptoms of Fusarium wilt.**—*Phytopathology*, xxxi, 3, pp. 281–283, 1 fig., 1941.

One of the earliest symptoms of the tomato wilt, due to *Fusarium bulbigenum* var. *lycopersici*, in inoculation experiments under the conditions already described [*R.A.M.*, xix, p. 170] at the United States Horticultural Station, Beltsville, Maryland, was observed to be epinasty, the angles formed between the stem and first mature leaf petiole on 18 affected plants ranging between 67° and 136° as compared with 51° to 55° on healthy ones. The following was the approximate sequence of disease effects on Bonny Best plants. The cotyledons and juvenile leaf began to show signs of epinasty on the third day, on the fourth two leaves above the juvenile became similarly affected, incipient chlorosis developed, and the veins at the base of the plant darkened so as to be visible through the cortex; the next day the three remaining leaves and bud showed an epinastic response; by the seventh day all the leaves had wilted and the veins of the stem were dark to within a short distance of the terminal bud; on the ninth the leaves were dead but still attached to the stem, which showed a watery softening, the entire vascular system was discoloured, the plant prostrate, and the stem only 6 in. long with five leaves, compared with 9 in. and eight leaves in the controls.

THOMPSON (G. E.). **Leaf-spot diseases of Poplars caused by Septoria musiva and S. populicola.**—*Phytopathology*, xxxi, 3, pp. 241–254, 2 pl., 1 fig., 1941.

Leaves of *Populus balsamifera* bearing *Septoria musiva* [*R.A.M.*, xviii, p. 770] were collected in the autumn and placed in wire baskets out of doors. The following spring the leaves bore perithecia of a species of *Mycosphaerella* believed to be new to science and named [with a Latin diagnosis] *M. populorum* n.sp. Inoculation experiments with this fungus in the greenhouse at Cornell University, New York, gave positive results on 26 species of *Populus*, including *P. balsamifera*, *P. berolinensis*, *P. canadensis* and its vars. *serotina* and *eugenei*, *P. candicans*, *P. maximowiczii*, three vars. of *P. nigra*, *P. robusta*, *P. tacamahaca*, and *P. tremuloides*, *P. alba* and *P. epirotica* remaining free from infection. The leaf-spotting caused by this fungus is widespread in the United States and Canada, the individual lesions being circular, irregular or angular, 1 to 15 mm. in diameter, reddish- to dark brown, with yellow borders, and sometimes zonate. Twig lesions or cankers were observed only on one twig of *P. szechuanica*. During 1936 the ascospores of *M. populorum*, which are irregularly biseriate, naviculate, uniseptate, and hyaline, measure 16 to 28 by 4·5 to 6$\mu$, and are borne in fasciculate, cylindrical-clavate, short stipitate asci, 54 to 70 by 13 to 16$\mu$, were discharged from the black, globose perithecia, 64 to 106 by 64 to 96$\mu$, following rain from 1st May to 29th August. The conidial stage developed on spots on living leaves throughout the summer and globose spermogonia, 48 to 96 by 48 to 80$\mu$, containing unicellular, oblong or rod-shaped, hyaline spermatia, 4 to 6·5 by 1·5$\mu$, were produced in September and October, this phase apparently not having been previously recorded. Isolations from ascospores and conidia usually gave rise to the same type of growth on potato dextrose agar at 24° C., consisting of compact, white colonies, with greyish-green centres and white-edged borders, the pycnidia embedded in which extruded pinkish masses of conidia. On the leaf the conidia were cylindrical or sometimes tapering, straight or curved, hyaline, 1- to 4-septate, 28 to 54 by 3·5 to 4$\mu$, but considerable variation was observed in this fungus and on dry, arid leaf spots the conidia were elliptic-fusiform to cylindrical, hyaline, continuous or uni- to biseptate, 12 to 29 by 3·5 to 4$\mu$. A certain number of cultures were atypical, failing to form greenish centres and produce conidia, while others were intermediate in respect of coloration and capacity for sporulation. The temperature range for ascospore germination in *M. populorum* was from 3° to 30°, with an optimum at 27°.

Leaves infected with *S. populicola* Peck (*Rep. N.Y. St. Bot.*, xl, p. 61, 1886) were also overwintered in wire baskets out-of-doors and developed the perithecial stage *M. populicola* n.sp. [with a Latin diagnosis]. Like the foregoing, this disease is confined to the United States and Canada. The lesions are similar to those produced by *M. populorum*, but individually smaller (1 to 8 mm. in diameter), though frequent coalescence results in the formation of blotches covering $\frac{1}{3}$ to $\frac{1}{2}$ the leaf area. The fungus is characterized by black, globose perithecia, 96 to 160 by 96 to 144$\mu$, and cylindrical-clavate, short stipitate asci, 64 to 90 by 13 to 16$\mu$, containing eight irregularly biseriate, fusiform, uniseptate,

hyaline spores, 22 to 32 by 6 to 6·5$\mu$. The conidial stage occurs in lesions on the living leaves during the summer, and in August and September are formed dark-coloured, globose or spherical spermogonia, 96 to 112 by 64 to 112$\mu$, containing oblong to rod-shaped, straight or slightly curved, unicellular, hyaline spermatia, 6·5 to 8 by 1 to 1·5$\mu$, this phase in the life-cycle of the pathogen being apparently hitherto undescribed. The type of growth produced by ascospores and conidia on potato dextrose agar resembled that characteristic of *M. populorum*. On the leaves the filiform to clavate, 2- to 5-septate, hyaline conidia measure 45 to 80 by 3·5 to 4·5$\mu$ (average length 62$\mu$) as compared with 54 to 99 by 4 to 5$\mu$ (average length 76$\mu$) in culture. The optimum temperature for growth was found to lie between 21° and 24°. Only three species of poplars reacted positively to inoculation with *M. populicola*, viz., *P. szechuanica*, *P. tacamahaca*, and *P. trichocarpa*.

Sylvén (N.). **Skogsträdens förädling. II.** [Improvement of forest trees. II.]—*Skogen*, xxviii, 5, pp. 81–83, 3 figs., 1941.

In connexion with a discussion of the problem of breeding in Swedish forest nurseries, the writer cites two fungal parasites attacking their hosts with such varying degrees of intensity that the selection of resistant individuals should present no great difficulty, viz., the devastating spruce rot [röta = (?) *Fomes annosus*: *R.A.M.*, xvi, p. 146] and birch rust [*Melampsoridium betulinum*: ibid., xv, p. 326]. In different nurseries plots of spruces are already being raised from seed derived from immune trees in the midst of heavily infected stands. An analysis of the rust incidence among 50 birches revealed two entirely free from infection, four showed only traces of the pathogen, 16 were slightly attacked, 14 somewhat more severely, four with moderate intensity, five heavily, and five very virulently by the disease. By the systematic selection for propagation of immune or highly resistant trees from badly diseased groups it should be feasible to develop a race of rust-immune birches.

Pady (S. M.). **Preliminary observations on the aecial hosts of Melampsorella.**—*Trans. Kans. Acad. Sci.*, xliii, pp. 147–153, 1 pl., 1940.

The writer discusses and tabulates the principal differences between the forms of *Melampsorella cerastii* occurring on its two aecidial hosts, *Picea engelmanni* and *Abies lasiocarpa*, in the Gothic district of Colorado. The witches' brooms produced by the rust on the former are much larger (up to 6 ft. in diameter) than those on the latter (1 to 2 ft.) and are reddish-orange instead of yellowish, the type of growth being diffuse on *P. engelmanni* and very compact on *A. lasiocarpa*; on the former host, the branches radiate in all directions while in the latter they all point upwards, and the leaves are much shortened and thickened. The pycnidia vary in a number of characters on the two kinds of tree, including their dimensions (99 to 135$\mu$ in height by 99 to 126$\mu$ in breadth on *P. engelmanni* and 31 to 62$\mu$ in height by 98 to 185$\mu$ in breadth on *A. lasiocarpa*), and the same applies to the aecidial stage, the spores measuring 18 to 33 by 14 to 21$\mu$ on the former and 14 to 23 by 10 to 18$\mu$ on the latter. Finally, the haustoria on *P. engelmanni* are long, finger-like, or clavate, measuring up to 40$\mu$ in length, while

those on *A. lasiocarpa* are knob-like or furnished with numerous terminal finger-like projections, up to 26$\mu$ long.

Two species of *Melampsorella*, rather than two variants of a single species, are thought to be probably concerned, but an examination of the teleutospore stage on *Cerastium* and *Stellaria* is necessary to settle this point.

BAXTER (D. V.). **Some resupinate Polypores from the region of the Great Lakes. XII.**—*Pap. Mich. Acad. Sci.*, xxvi (*1940*), pp. 107–121, 7 pl., 1941.

This further instalment of the writer's critically annotated list of resupinate Polypores from the Great Lakes region of the United States [*R.A.M.*, xix, p. 685] comprises seven species, of which three are new [with Latin diagnoses], viz., *Poria taxodium* on *Taxodium distichum* in Illinois, *P. carnicolor* on *Tsuga heterophylla* in Idaho, and *P. carnegiea* on *Carnegiea gigantea* in Arizona, the last-named being the first Polypore to be recorded on cactus. *Coriolellus cuneatus* Murr. on *Thuja plicata* in British Columbia is renamed *Polystictus cuneatus* comb. nov.

*Poria taxodium* presents many features in common with *P. xantha* [ibid., xviii, pp. 76, 362] or its var. *crassa*, from which it differs, however, in its spore dimensions of 4 to 5·5 by 4$\mu$ instead of 4 to 6 by 1 to 1·5$\mu$. The spores of *P. vulgaris*, another allied species, measure 4 to 6 by 1 to 1·5 or 2$\mu$. Attention is drawn to the prevalent confusion in the current interpretations of *P. vaporaria*, one designating a common greenhouse fungus (herein referred to as *P. vaillantii*) with spores measuring 5 to 7 by 3 to 3·5$\mu$ and the other (*P. vaporaria* proper) being the Polypore of Swedish pine forests. The fungus described by Gäumann as *P. vaporaria* [ibid., xviii, p. 493] is actually *P. versipora* (Pers.) Romell. *P. vaillantii*, which also causes a rot of basement timbers resembling that due to *Merulius lacrymans*, closely resembles *P. taxodium*, but the two may be differentiated by the rhizomorphic growth habit and somewhat larger pore mouths of the former.

Hitherto no special precautions against the spread of *Fomes annosus* have been necessary in American forests, but indications are not wanting that it may eventually become as serious a cause of plantation failure, e.g., in North Carolina and California, as it already is in Europe. The fungus is the indirect agent of a certain amount of windfall in the United States and in some localities is responsible for widespread decay in mining timbers.

VERRALL (A. F.). **Fungi associated with stain in chemically treated green lumber.**—*Phytopathology*, xxxi, 3, pp. 270–274, 1941.

Continuing his studies on the fungal staining of green timber in the southern United States [*R.A.M.*, xix, p. 315], the writer determined the fungi occasionally associated with the defect on treated lumber. In his tests the wood was treated with 0·31 per cent. lignasan (6·25 per cent. ethyl mercuric chloride) and 1·03 per cent. dowicide (sodium tetrachlorophenolate and sodium 2-chloro-ortho-phenyl phenolate, 1:1) [ibid., xviii, p. 363 *et passim*]. In pine wood (both treated and untreated) *Ceratostomella pilifera* was the principal agent of staining, followed by *C. ips* [ibid., xx, pp. 315], the former being isolated from

71 per cent. of the samples in both the lignasan-treated and control lots, and from 87 and 73 per cent., respectively, in the dowicide-treated and control, while the corresponding figures for the latter were 11, 13, 13, and 14 per cent., respectively. None of the other fungi present caused more than 6 per cent. infection. On hardwoods both treatments reduced the incidence of infection by *C. pluriannulata*, lignasan from 71 to 37 and dowicide from 77 to 23 per cent., the corresponding figures for *Graphium rigidum*, *Diplodia natalensis*, and *Endoconidiophora moniliformis* being from 48 to 27 and 35 to 8 per cent., from 19 to 0 and 21 to 0 per cent., and from 29 to 2 and 42 to 15 per cent., respectively. *E. coerulescens*, on the other hand, proved refractory to control by either of the chemicals. No differences in the staining flora occurred on treated and untreated hardwood, and although some were observed in the fungi on treated and non-treated pine these are insufficient to account for the severe staining which sometimes occurs.

Cartwright (K. St. G.). **Dry rot outbreak after fire. Damage and how it can be prevented.**—*Builder, Lond.*, clix, 5094, p. 291, 1940.

Every year a proportion of the numerous cases of dry rot [*Merulius lacrymans*] submitted to the Forest Products Research Laboratory is found to originate as a sequel to fire damage, and attention is drawn to the likelihood of an increase in such outbreaks owing to the risk of incendiary bombs necessitating the use of large quantities of water, which thoroughly soak the woodwork and provide ideal conditions for the development of the fungus, especially where buildings have to be evacuated for considerable periods. Essential precautions to minimize damage of this kind include a preliminary waterproofing of the roof, gutters, &c., before embarking on further repairs; removal of all floor coverings, which retard the escape of moisture, and of damp insulating material ('deafening') between floors and ceilings; and provision of adequate ventilation combined with a warm atmosphere (the latter alone tends to accelerate the progress of the rot).

Niethammer (Anneliese). **Microscopic fungi in mechanical and groundwood pulp.**—*Zellstoff u. Papier*, xx, 9, pp. 266–268, 270; 10, pp. 298, 300, 302, 304, 1940. [German. Abs. in *Bull. Inst. Pap. Chem.*, xi, 6, p. 200, 1941.]

Experiments [at the German Technical College, Prague] showed that various species of *Trichoderma*, *Penicillium*, *Cladosporium*, *Aspergillus*, *Macrosporium*, *Fusarium*, and *Verticillium* are capable of growth on sulphite, soda, and groundwood pulps, moisture and small quantities of salt in solution being essential to their development. The species of *Fusarium* concerned were found to prefer low temperatures, a factor deserving consideration in the selection of storage rooms: *Aspergillus* spp., on the other hand, thrive only at temperatures above those prevailing in ordinary rooms. A mutual antagonism, of potential value for control purposes, was shown to exist between some of the fungi involved in pulp spoilage; *Penicillium* spp., for example, may be overgrown and destroyed by *Cladosporium* and *Fusarium* spp. While some of the organisms under observation are confined to the surface, others penetrate more deeply into the pulp and may ruin the entire stock.

All moist material, especially when contaminated by any kind of impurity, must be regarded as liable to fungal invasion. Dilute solutions of sulphur dioxide were effective against the spores, conidia, and hyphae of the pathogens without injuring the pulp.

BURKHOLDER (W. H.). **The black rot of Barbarea vulgaris.**—*Phytopathology*, xxxi, 4, pp. 347–348, 1941.

*Phytomonas barbareae* n.sp. (or *Xanthomonas barbareae* if Dowson's system of bacterial nomenclature [*R.A.M.*, xviii, p. 659] be accepted) is the name proposed for a pathogen of the prevalent New York weed *Barbarea vulgaris* suspected of being identical with *P.* [*Pseudomonas*] *campestris*. In culture it presented the same appearance as the latter, but cross-inoculation experiments with the two organisms and *Phytomonas campestris* [*Bacterium campestre*] var. *armoraciae* [ibid., viii, p. 543] showed the three to be distinct pathologically, each producing infection on its own host but slight or none on the others.

JACOBS (S. E.). **Brown heart disease in Turnips.**—*Gdnrs' Chron.*, Ser. 3, cix, 2827, p. 91, 1 fig., 1941.

Attention is drawn to the occurrence of brown heart in substantial amounts in a turnip crop on an allotment at Morden, Surrey, this being the first record of the disease in the home counties, though it is becoming widespread elsewhere in Great Britain [*R.A.M.*, xv, p. 416]. The symptoms of the disorder are briefly described and recommendations made for its control by the application to the soil, shortly before sowing, of borax at the rate of 20 lb. per acre (approximately 6½ oz. per 100 sq. yds.).

GRIES (H.). **Quantitative determination of blackleg in Sugar Beets and the efficiency of seed disinfectants.**—*Z. WirtschGr. Zuckerindust.*, xc, [3], pp. 197–206, [1940. German. Abs. in *Facts ab. Sug.*, xxxvi, 3, p. 33, 1941.]

The writer has devised a reliable method, hitherto lacking, for the determination of the relative utility of the different fungicides used against black leg of sugar beet. In one plot the germination of untreated seed is determined in sterilized soil, and in another the treated lot is planted in the same soil inoculated with the spores of *Pythium* [? *de Baryanum*]. The results are evaluated on the following basis. The germination test shows the number of seedlings to be expected in the absence of attack by soil fungi. In the infected soil the number of healthy seedlings, expressed as a percentage of the germination in sterile soil, gives the percentage efficiency of the treatment. The total count of diseased and healthy seedlings in the inoculated soil is seldom or never equal to the stand in sterile ground, since some of the germinating seeds are killed by *P.* (?) *de Baryanum* before emergence. It would thus be erroneous to figure the diseased plants as a percentage of the total number counted; the germination test must be made to provide the real basis for calculation. Investigations by this method have demonstrated the efficacy of dusts for the control of *P.* (?) *de Baryanum* and *Aphanomyces* [*levis*: *R.A.M.*, xv, p. 763].

LECLERG (E. L.). **Comparative studies of Sugar-Beet and Potato isolates of Rhizoctonia solani.**—*Phytopathology*, xxxi, 3, pp. 274–278, 1941.

In comparative studies of the morphology, physiology, and pathogenicity of ten isolates of each of four groups of *Rhizoctonia* [*Corticium*] *solani*, from sugar beet, stem lesions on older potato plants, stolon lesions, and tuber sclerotia [*R.A.M.*, xx, p. 175], four from potato stem lesions and six from sclerotia did not differ significantly in hyphal diameters, but nine of those from sugar beet were appreciably smaller (7·8 to 9$\mu$) than any of the potato strains (9·2 to 11·4$\mu$). The sugar beet isolates grew more rapidly on potato dextrose and high nitrogen agars (the latter prepared according to F. A. Heck's formula in *Soil Sci.*, xxvii, pp. 1–48, 1929) than any of those from potato. The optimum temperature for the growth of the isolates from the mature potato plant, stolons (excepting those able to cause dry rot canker of beets), and sclerotia was 25° C. or below, whereas 19 out of 20 sugar beet strains and those from stolon lesions capable of inducing beet canker throve best at 30°. As a group, the sugar beet isolates of *C. solani* caused a higher percentage of damping-off in sugar beets, beans [*Phaseolus vulgaris*], peas, and cabbage than any of three groups from potato, the percentages of emergence in the four hosts infected by the sugar beet strains being only 9, 27, 13, and 28, respectively, compared with 74, 84, 63, and 69, respectively, for those infected by strains from potato stolon lesions; 82, 91, 70, and 70, respectively, for the stem lesion isolates; and 82, 92, 80, and 72, respectively, for those from sclerotia.

GREEN (D. E.). **Hygiene in the war-time vegetable garden. IV.**—*J.R. hort. Soc.*, lxvi, 4, pp. 130–136, 6 figs. (facing p. xxxiii), 1941.

Continuing his series of directions for the control of vegetable diseases in war-time allotments [*R.A.M.*, xx, p. 238], the author deals with some well-known pathogens of broad, dwarf, and runner beans, and celery.

STELLWAAG (F.). **Forschungsaufgaben des weinbaulichen Pflanzenschutzes.** [Research problems confronting viticultural plant protection.]—*Forschungsdienst*, xi, 2, pp. 153–160, 1941.

Among the most urgent problems awaiting solution in the sphere of viticultural plant protection in Germany are the following: (1) those connected with various aspects of the control of downy mildew (*Peronospora*) [*Plasmopara viticola*], including improvements in the accuracy of forecasting outbreaks by means of the incubation calendar [*R.A.M.*, xix, p. 325]; (2) chlorosis, found on a recent tour of inspection to have been accentuated to such a degree by the cumulative rains of 1939 and 1940 as to entail complete loss of productivity in vines covering an area of 5,000 ha.: the detection of spots on the wood of affected American varieties may be a sign of parasitic intervention in the development of this trouble; and (3) the numerous forms of true and spurious degeneration, the former comprising mosaic and possibly the 'reisig' and 'roller' diseases [ibid., xviii, p. 652], and the latter associated, *inter alia*, with adverse environmental conditions and pathogenic agents.

**Peronóspora en los viñedos.** [Peronospora in the vineyards.]—*Bol. agríc., Mendoza*, viii, 10–12, pp. 275–276, 1940.

The attention of viticulturists is drawn to the appearance in certain districts of Mendoza, Argentine Republic, of vine downy mildew (*Peronospora*) [*Plasmopara viticola*], immediate steps to prevent the spread of which should be taken by treatment with 1·5 per cent. Bordeaux mixture.

Lindfors (T.) & Holmberg (C.). **Växtsjukdomar i Sverige 1933–37.** [Plant diseases in Sweden 1933–1937.]—*Medd. Växtskyddsanst., Stockh.*, 33, 131 pp., 3 figs., 4 maps, 1941.

This is a valuable fully documented survey of the plant diseases recorded among agricultural and horticultural crops in Sweden from 1937 to 1940.

[Waterston (J. M.).] **Plant pathology.**—*Rep. Dep. Agric. Bermuda, 1940*, pp. 6–8, 1941.

In this report [cf. *R.A.M.*, xix, p. 517] it is stated that owing to heavy virus infection of seed potatoes from Long Island in recent years, an attempt was made to grow equally good seed potatoes locally. Bliss Triumph seed from Nova Scotia was planted in February, and as the plants grew they were inspected for virus attack, and the diseased ones removed. The potatoes were dug towards the end of May, and placed in cold storage until September, when they were planted. The resulting crop proved to be conspicuously free from disease, only 3·7 of the plants showing leaf roll. Seed from fields not rogued showed 17 per cent. infection, and seed from Long Island 40 per cent. The yield from the Bermuda-grown seed was much in excess of that from the imported.

Interesting disease records made during the year included a rot of the sterile flowers and fruit of Cavendish banana due to *Sclerotinia sclerotiorum*, a leaf spot of guava due to *Gloeosporium psidii*, grapefruit scab (*Sphaceloma fawcettii*) [*Elsinoe fawcetti*], and peach leaf curl (*Taphrina deformans*). Diseases recorded for the first time locally were sorghum smut (*Sphacelotheca sorghi*) and groundnut leaf spot (*Cercospora personata*). A decay of cassava tubers was caused by *Diplodia* [*Botryodiplodia*] *theobromae* [ibid., xv, p. 278].

Reed (G. M.). **Reports on research for 1940. Plant pathology.**—*Rep. Brooklyn bot. Gdn, 1940* (*Brooklyn bot. Gdn Rec.*, xxx, 2), pp. 81–93, 1941.

Many additional $F_3$ progenies of a hybrid between Navarro and Hull-less oats were grown during the period under review, 225 being inoculated with race 12 of loose smut [*Ustilago avenae*] and 226 with race 7 of covered smut [*U. kolleri*: *R.A.M.*, xix, p. 526]. The inheritance of resistance to covered smut (races 3 and 7, the former used in last year's tests) was shown to depend on three factors. The results obtained in the loose smut experiments differed materially both from those secured with race 1 [loc. cit.] and from the outcome of the covered smut tests. Relatively few of the progenies were resistant, and many proved to be highly susceptible.

Most of the 40 collections resulting from L. G. Utter's hybridization of races 1 of *U. avenae* and *U. kolleri* [ibid., xix, p. 527] produced heavy infection on the Gothland variety, normally resistant to the latter though very susceptible to the former, and on Monarch, in which the reactions are normally the opposite of the foregoing. Gothland and Early Champion were susceptible to all 15 of the covered smut races now established, while Monarch was resistant to 11 of them and Fulghum and Joanette to all. Eight of the nine known races of *U. avenae* were highly pathogenic to Monarch, while Gothland was susceptible to six. Green Mountain and Early Champion, susceptible to race 1 of *U. avenae*, were resistant to all the hybrid races, while Fulghum and Joanette, resistant to race 1 of *U. avenae*, were susceptible to all the hybrids.

Previous investigations by D. Elizabeth Marcy had shown the contributory influence of conditions retarding the growth of sorghum seedlings on susceptibility to covered smut [*Sphacelotheca sorghi*: loc. cit.]. Stunting by removal of part of the seed endosperm before inoculation and planting entails somewhat heavy mortality in the susceptible Dakota Amber Sorgo varieties, but all the surviving plants became infected, compared with 94 and 97 per cent. in the series with the endosperm left intact. In the case of Red Amber Sorgo, 49 per cent. of the seedlings subjected to partial endosperm removal were smutted compared with 31 per cent. of the intact series. Endosperm removal also appeared to promote the peculiar type of infection in Feterita known as 'blasting' (29 per cent. as against 18 in the intact series). Pre-soaking of the seed for 48 hours, especially with frequent changes of water, was found to be conducive to infection both by covered and loose smut [*S. cruenta*], Red Amber Sorgo, for instance, contracting 73 per cent. infection by *S. sorghi* after this treatment as compared with 66 per cent. for the controls, the corresponding figures for Dawn Kafir being 95 and 56 per cent., respectively; Milo, which normally seldom produces a smutted plant, developed a low percentage of infection following pre-soaking.

**Plant pathology.**—*Rep. Ariz. agric. Exp. Sta., 1939–40*, pp. 90–102, 6 figs., 1 graph, 1941. [Mimeographed.]

In the course of extensive field experiments during the period under review [cf. *R.A.M.*, xvii, p. 503], complete control of angular leaf spot of cotton [*Xanthomonas malvacearum*] was secured by delinting with [sulphuric] acid, with or without the added precaution of dusting with ceresan. A few diseased plants occurred among the stands raised from fuzzy ceresan-treated seed, while untreated material gave rise to infection ranging from a trace to semi-complete. The early disappearance (by 20th July) of the disease from primarily infected seedlings in most of the fields under observation is presumed to have been due to the exceptionally dry conditions prevailing during the season.

*Verticillium* wilt of cotton behaved in a very erratic manner, the Acala crop in some heavily infected fields suffering little or not at all, while in others up to 50 per cent. reduction in yield resulted, suggesting the existence of strains of varying degrees of virulence.

*Sclerotium rolfsii* [ibid., xviii, p. 25], hitherto unknown in a severe

form in Arizona cotton fields, caused a sudden wilt and death of the plants, leaving extensive gaps in the stands. Decaying cotton stalks in the soil, ploughed under from the preceding season, constitute one source of infection.

During the three-year period from 1937 to 1939, a total of 1,636 out of 6,800 (24 per cent.) pecan trees 6 to 20 years old, in five 80-acre orchard plots subjected to various kinds of intercropping and soil treatments, contracted infection by *Phymatotrichum omnivorum* [ibid., xvii, p. 504]. Most of the treatments consisted of combinations of ammonium sulphate or ammonium phosphate and agricultural sulphur at a basic rate of 1 lb. of each chemical per 10 sq. ft. root area, followed by a 4-in. irrigation. In the four treated plots only 1·5 per cent. of the trees died compared with 10·6 per cent. in the untreated control area. The small number of new infections and trees dying from June to November, 1939, in three of the treated plots (5, 21, and 16, and 1, 3, and 3, respectively), indicate that the root rot is under control in these orchards. A 10-acre plot in a severely infected, untreated grove intercropped with lucerne in 1937 and 1938 contained 4·4 per cent. dead trees in June, 1937; 2½ years later, 29·5 per cent. more trees had succumbed and 37 per cent. were infected, leaving only 29 per cent. apparently sound.

English seed peas treated against damping-off of miscellaneous fungal origin with new improved ceresan, cuprocide, vasco 4, or semesan produced percentage stands of 35, 55, 38, and 45, respectively, compared with 23 for the untreated controls, the corresponding figures for sugar beet being 45, 48, 49, 48, and 23, respectively.

Tomato yellows [curly top], the virus of which is carried by the beet leafhopper [*Eutettix tenellus*: ibid., xx, p. 37], is the most serious disease of the crop in the State. Details are given of experiments involving the protection of plants of the Earliana, Valiant, and Rutgers varieties by cheesecloth tents from transplanting on 23rd May until 10th June or harvest time, the results of which showed that the disease may be effectively combated by this means, the longer period of covering being preferable. The unprotected control plants were mostly (81·4 per cent.) dead by 1st August. The cost of the cheesecloth amounted to 2½ cents per plant.

The one citrus disease of commercial importance in Arizona is dry root rot, a severe outbreak of which in a 7-acre grove of Valencia oranges in the autumn of 1939 resulted in the death of 52 trees, another 22 being definitely infected and a further 32 under suspicion. Most of the trees treated in December with the chemical combinations found effective against *P. omnivorum*, as described above, responded favourably. A number of trees grafted on rough lemon stocks remained free from root rot.

A new bud rot of *Canna* is attributed to *Phytomonas* [*Pseudomonas*] *cannae*. *Washingtonia gracilis*, resistant to the bud rot caused by *Phytophthora palmivora*, should be substituted for *W. filifera* in the Salt River Valley, where the disease is destructive.

Symptoms of bacterial necrosis of the giant cactus (*Carnegiea gigantea*) [ibid., xx, p. 210] are circular, pale spots with water-soaked margins on the trunk and branches, the underlying tissues turning

brown to black and decaying, a dark, watery exudation being typical of cases of rapid infection; in the final stages, the 'flesh' falls away, leaving a bare framework, unless the weakened trunk has already been broken off by wind. In dense plantings, a weakened tree may lean against a healthy one and infect it. Decayed spots should be excised in the incipient phase and the resultant wounds disinfected and coated with a water-soluble asphalt paint, badly diseased and fallen trees being destroyed.

WINTER (A. G.). **Ein neuer Fußkrankheitserreger an Weizen, Gerste, Roggen und Hafer (Colletotrichum graminicolum [Ces.] Wilson).** [A new foot rot pathogen on Wheat, Barley, Rye, and Oats (*Colletotrichum graminicolum* [Ces.] Wilson).]—*Phytopath. Z.*, xiii, 3, pp. 282–292, 9 figs., 1940.

A foot rot new to Germany was observed to occur on wheat, rye, barley, and oats in the experimental fields of the Phytopathological Institute of Bonn University in 1938, without causing significant losses. A fungus isolated from sclerotia found on lesions was proved to be the causal agent of the disease by inoculation. The sclerotia occurred in tissues of the leaf sheath, stem, and roots. No fructifications were found, but the fungus is believed to be specifically identical with *Colletotrichum graminicola* described by Sandford [*R.A.M.*, xiv, p. 574] on oats, although since the host range is different and sclerotial formation occurs on the roots of seedlings the author assumes that different forms or races of the fungus are involved.

TRAYLOR (J. A.). **Hyperparasites attacking rust fungi in Oklahoma.**—*Proc. Okla. Acad. Sci.*, xx, pp. 57–58, 1940.

*Darluca filum* [*R.A.M.*, xix, p. 730] has been found in Oklahoma parasitizing *Puccinia amphigena* on *Calamovilfa gigantea*, *Uromyces graminicola* on *Panicum virgatum* [ibid., xx, p. 264], *U. peckianus* on *Aristida oligantha*, and *U. lespedezae* on *Lespedeza* [ibid., xiv, p. 516]. The setae supposedly typical of *D. filum* spores were largely absent in the local collections and are apparently not a constant character of the species. *D. filum* was transferred from *U. graminicola* to *Puccina triticina* on wheat, the pycnidia of the hyperparasite developing on the inoculated rust sori in six days at a mean temperature of 65° F. *D. filum* was obtained from only one out of 300 wheat leaf rust samples collected in the State, but developed in profusion on *P. triticina* in a greenhouse epidemic in 1939 under conditions favouring the growth both of the wheat plants and their pathogen.

ROBBINS (W. J.). **Biotin and the growth of Fusarium avenaceum.**—*Science*, N.S., xciii, 2419, pp. 437–438, 1941.

A strain of *Fusarium avenaceum* obtained from South Africa was found not to grow on a solution of mineral salts and sugar, but to grow on the same solution solidified with agar. The beneficial effect of agar is ascribed chiefly to the action of biotin; when the biotin was extracted from the agar, the growth-promoting effect ceased. The amount of biotin present varied with the samples of agar, amounting to approximately 0·1 microgram per gram in some. Even 0·001 microgram of

pure biotin had a beneficial effect on the growth of the fungus in liquid culture, and amounts up to 0·1 microgram per culture further increased the dry weight. Some isolations made from old cultures of the organism grew in the absence of biotin; these are considered to be saltations or dissociations.

DÉFAGO (G.). **Effets de l'aneurine, de ses composants et de l'hétéro-auxine sur la croissance de trois parasites du Blé.** [The effects of aneurin, of its constituents, and of hetero-auxin on the growth of three Wheat parasites.]—*Phytopath. Z.*, xiii, 3, pp. 293–315, 5 figs., 1940.

This is an expanded account of the author's preliminary paper describing experiments on the effect of aneurin on *Tilletia tritici* [*T. caries*], *Cercosporella herpotrichoides*, and *Ophiobolus herpotrichus*, with particular reference to the parasitism of these fungi [*R.A.M.*, xix, p. 649].

The results obtained with *T. caries* showed that the whole aneurin molecule was necessary for the growth of the fungus. The two constituents of aneurin, pyrimidin and thiazol [cf. ibid., xix, p. 723], were unable to replace aneurin in this respect, either separately or together. Hetero-auxin [indole-acetic acid] began to be harmful to the growth of *T. caries* at a concentration as low as $4 \cdot 10^{-10}$. Gelose reduced this effect, and very low concentrations of the hetero-auxin favoured growth. Aneurin had no effect on chlamydospore germination, but markedly stimulated the growth of the promycelium. In the dosages tested the hetero-auxin inhibited chlamydospore germination.

The experiments with *C. herpotrichoides* showed that its sensitiveness to hetero-auxin was somewhat less marked than that of *T. caries*, the lethal concentration being $4 \cdot 10^{-6}$.

*O. herpotrichus* showed almost complete auxo-autotrophy towards aneurin, and a weaker sensitiveness to hetero-auxin.

It is concluded that aneurin has indirectly an influence on the susceptibility and resistance of wheat to bunt. Hetero-auxin and perhaps the natural auxins are probably factors in passive resistance. Hyperproduction of auxin under the influence of the parasite is probably a form of active resistance, of local, histological immunity.

ZAZHURILO (V. K.) & SITNIKOVA (Mme G. M.). **Natural ways of transmission of the Winter Wheat mosaic virus.**—*C.R. Acad. Sci. U.R.S.S.*, N.S., xxix, 5–6, pp. 429–432, 1940.

In winter wheat crops in the province of Voronezh, U.S.S.R., the symptoms of mosaic [*R.A.M.*, xx, p. 157] were observed during the period of the writers' observations from 1935 to 1939 to appear in the autumn, over 10 per cent. infection being present by the winter in seasons when a warm, damp spell supervenes after the harvest. The next year the proportion of diseased plants increases considerably through latent infection, showing that the virus overwinters in the invaded stands.

Early sowing was found to predispose wheat crops to mosaic, the incidence in stands sown on 1st, 5th, and 10th September, 1938, being 13·8, 5·8, and 5·4 per cent., respectively. On the other hand, spring

oats planted on 5th May, 1938, were more severely affected (10 per cent.) than those sown on 24th April (3·6).

Studies on the life-cycle of the insect vector (*Deltocephalus striatus*) of the wheat mosaic virus in relation to the phenology of the host pointed to the third generation, hatched in the autumn, as the principal agent of infection: it develops mainly among the stubble of late spring crops and on plots overgrown with cereal weeds, such as *Setaria viridis* and *S. glauca*. The critical period for the infection of the winter crop thus extends from the germination of the seed in the autumn until the advent of persistent frosts. On the other hand, the first (spring) generation of the insect is the only one of any importance in the infection of spring crops (oats in these experiments). Control measures should be based on cultural practices tending to reduce the incidence of infection on winter crops (the chief sufferers from the disease), e.g., early ploughing of fallow ground, eradication of weeds, and destruction of 'volunteer' plants, which constitute an important link in the developmental cycle of mosaic. The attention of plant-breeders should be directed in the first instance towards the establishment of resistance in winter varieties, after which the freedom of the spring crops from disease will follow automatically.

Tyner (L. E.). **Some factors affecting the virulence of artificial inoculum of Helminthosporium sativum P. K. and B. and of Fusarium culmorum (W. G. Sm.) Sacc.**—*Canad. J. Res.*, Sect. C, xix, pp. 42–48, 1941.

In greenhouse experiments in Alberta, steam-sterilized black loam soil mixed with various amounts of maize meal was inoculated with spore suspensions of *Helminthosporium sativum* and *Fusarium culmorum* [*R.A.M.*, xix, p. 649]. When this inoculum was applied to grain sown in sterilized and unsterilized soil, the amount of maize meal added to the medium and the period of incubation caused significant differences in the number and dried weight of surviving wheat plants and weighted infection ratings. Inocula of either organism containing 12 per cent. maize meal were more pathogenic than those containing 5 per cent. Inoculum of *H. sativum* incubated for 14 days was considerably more pathogenic than that incubated for 21, 28, or 35, but with *F. culmorum* the age of the inoculum did not seem to exert any effect. The size of the flask in which the inoculum was incubated was of little importance if desiccation was avoided. These data are taken to indicate that in order to prevent organic matter in the inoculum from causing increased virulence of the fungi in soil, the amount of carbohydrate added should be the minimum commensurate with good growth of the pathogen. The importance of standardized technique in the preparation of media for the culture of the soil-inhabiting fungi used as inocula, is stressed.

Saboe (L. C.) & Hayes (H. K.). **Genetic studies of reactions to smut and of firing in Maize by means of chromosomal translocations.**—*J. Amer. Soc. Agron.*, xxxiii, 5, pp. 463–470, 1941.

At the Minnesota Agricultural Experiment Station from 1937 to 1939, $F_1$ crosses between smut (*Ustilago zeae*)-susceptible interchange lines of maize and two resistant inbred lines derived from Rustler and

Minnesota No. 13 were back-crossed to the resistant inbred parents, and a study was made of the linkage relations between chromosomal translocation and smut reaction in the resultant progeny [*R.A.M.*, xix, p. 273].

Significant associations between smut reaction and point of translocation were observed in interchanges 3 to 7*b*, 5 to 7*d*, 6 to 9*a*, and 8 to 10*a* in the crosses with the inbred line of Minnesota No. 13, and in 1 to 4*a*, 3 to 5*c*, and 5 to 8*a* in the Rustler crosses. The Minnesota No. 13 crosses yielded indications that at least three factor pairs or linked groups of factors are responsible for the reaction to *U. zeae*, one possibly located in the long arm of chromosome 7, one in the short arm of chromosome 6, and one in the long arm of chromosome 8. In the Rustler crosses the smut reaction appears to depend on at least two, perhaps three, factor pairs or linked groups of factors, located, respectively, in the short arm of chromosome 4, either in the long arm of chromosome 3 or in that of chromosome 5, and either in the long arm of chromosome 8 or somewhere in chromosome 5. The location of factors for smut resistance in the Rustler and Minnesota No. 13 inbreds appears to be somewhat different.

GASSNER (G.). **Untersuchungen über das 'Mal secco' oder 'Kurutan' der Limonbäume.** [Investigations into the 'mal secco' or 'kurutan' of Lemon trees.]—*Phytopath. Z.*, xiii, 1, pp. 1–90, 48 figs., 1 graph, 1 map, 1940.

The 'mal secco' disease of citrus [*R.A.M.*, xv, p. 575] is stated to be generally distributed along the whole Mediterranean coast of Turkey, attacking mainly and seriously lemon, but also young sour orange and *Citrus medica* trees, while older sour orange trees are highly resistant, and sweet oranges almost, and tangerines entirely, immune. The causal fungus, *Deuterophoma tracheiphila* [loc. cit.], the pathogenicity of which was proved by artificial infection, is very probably identical with *Phoma limoni* von Thümen. It was established that symptoms such as vessel infiltrations and disturbances in the cambium zone, which have commonly been ascribed to 'mal secco', are actually due to frost injury. In the primary stage of 'mal secco', which extends from January to April, the disease spreads from the tips of the branches towards the base. During the summer progress in development is slow, but in October the latent mycelium spreads into the healthy parts and eventually kills the tree within a few months. The infection is believed to originate in tips injured by frost. This explains the fact that considerably larger numbers of new infections can be observed after severe winters than after mild ones, when they are often altogether absent. It also accounts for the greater susceptibility of the frost-sensitive lemon to the disease. Among Turkish lemon varieties, Molla Mehmed was found to be fairly resistant to 'mal secco' and in possession of all those physiological characteristics which ensure a low frost sensitivity.

GASSNER (G.). **Untersuchungen über das Citrus-Sterben von Dörtyol oder die Gelbnervigkeit der Citrusbäume.** [Investigations on the dying-off of Citrus in Dörtyol or the vein-yellowing of Citrus trees.] —*Phytopath. Z.*, xiii, 2, pp. 97–125, 31 figs., 1940.

Observations started in the winter of 1934 showed that about 60 to

70 per cent. (or roughly 100,000) of the citrus trees growing in the Dörtyol district of Turkey, where the cultivation of this fruit is practised on a commercial scale, suffered from a disease characterized by vein-yellowing of the leaves and, in advanced stages, by bark decay and rot at the collar and lower part of the stem. The name 'brown root gummosis and foot rot' [*R.A.M.*, xv, p. 575] is commonly used for these secondary symptoms, but the author considers the primary symptoms as more characteristic and accordingly proposes the term 'Gelbnervigkeit' [vein-yellowing] instead. The yellowing first affects the main vein, then the lateral veins of the leaf, and later the whole lamina becomes discoloured. It is easily distinguishable from mottle leaf, in which the veins remain green longest, but both diseases may occur simultaneously on the same tree.

Deep planting and subsequent earthing-up is considered to be the primary cause of the disease, with bark rot due to attack of the weakened lower part of the stem by *Phytophthora* spp. as a secondary development. The fungi are, therefore, of no importance in spreading the disease. The opinion that the disease is due to an interrupted sap movement caused by deep planting was supported by field observations of over 100 cases in which diseased leaves were invariably found to have an injured main vein (mechanical injury brought about by wind or hail). The part of the leaf above the injury showed yellowing, whereas that below was normally green; the same development was observed in young citrus trees damaged by animals. Experimental injury to the main vein of leaves resulted in the development of symptoms fully agreeing with those observed in the field. It is concluded that the interruption of the rising sap flow and the subsequent blockage of assimilates is responsible for the disease. Although deep planting is also practised with other fruit trees in this district, vein-yellowing was exhibited by citrus foliage only.

The large-scale control campaign carried out during the winter of 1938 met with complete success. Trees in the early stages of disease recovered rapidly when the collar was laid open, both bark and leaves regaining their normal colour; trees in the later stages with bark affected by decay needed more time to recover, but eventually the bark healed by forming callus. Negative results were obtained only with trees in very advanced stages, when almost the entire bark of the lower part of the stem had been destroyed. Attempts to control the disease by uncovering the collar were made by several citrus-growers in 1935 with similar success. For the future it is recommended that deep planting of young trees and the practice of covering up with earth the lower part of the stem be avoided. The application of fungicides is considered superfluous.

Biale (J. B.) & Shepherd (A. D.). **Respiration of Citrus fruits in relation to metabolism of fungi. I. Effects of emanations of Penicillium digitatum Sacc. on Lemons.**—*Amer. J. Bot.*, xxviii, 4, pp. 263–270, 2 figs., 1941.

The exposure of freshly picked green lemons under strictly controlled conditions at 14·5° C. to vapours from mouldy fruit inoculated with *Penicillium digitatum* [*R.A.M.*, xix, p. 470], resulted in a very marked

increase (up to 97 per cent.) in the rate of respiration and a definite acceleration in the colour development of the fruit. A single mouldy fruit was capable of producing an 80 per cent. increase in the carbon dioxide production of 500 normal lemons. The formation of the active vapour by the fungus was apparently not increased by raising the temperature to 20° or 25°, but it was inhibited at 2·5°. Similar general results were obtained when cultures of *P. digitatum* on a dextrose-potato broth agar medium were used instead of the mouldy fruit. Tests with pea seedlings indicate that epinasty is induced by emanations of this fungus.

Bocharova (Mme Z. Z.). **Diseases of Citrus fruit in storage. I. Botrytis cinerea on stored Citrus fruit.**—*Microbiology*, viii, pp. 1187–1193, 1940. [Russian, with English summary. Abs. in *Chem. Abstr.*, xxxv, 10, p. 3351, 1941.]

Temperature reduction was found merely to restrict the proteolytic activity of *Botrytis cinerea* on stored citrus fruits in the U.S.S.R. [*R.A.M.*, xviii, p. 671], the mould being capable of development at —5° C. The disease is controllable by selection and careful packing of the fruit. Spanish oranges and Italian lemons held under refrigeration were almost completely resistant to infection.

Fawcett (H. S.). **Adventures in the plant-disease world.**—34 pp., 10 figs., 1 diag., 1 graph, Berkeley, Univ. Calif. Press, 1941. 50 cents.

In this lecture the author vividly describes in popular language some of the more striking aspects of his studies on certain diseases affecting the citrus crops of the United States.

Bitancourt (A. A.). **A podridão das radicelas dos Citrus na provincia de Corrientes, Argentina.**—*Biologico*, vi, 10, pp. 285–288; 12, pp. 356–364, 8 figs., 1 map, 1940; vii, 3, pp. 62–69, 1941.

This is a comprehensive account of the root rot ('Bella Vista disease') of citrus in the province of Corrientes, Argentine Republic [*R.A.M.*, xv, p. 716], embodying the observations made and conclusions reached by the author and H. S. Fawcett during a tour of inspection of the affected areas in 1937. Hitherto the only species attacked are the sweet orange, tangerine, and possibly pomelo grafted on sour orange stocks. The various theories advanced in explanation of the disease are discussed: those involving physiological causes or incompatibility between stock and scion may in all probability be rejected, while the part played by fungi (notably *Colletotrichum gloeosporioides*) appears to be purely secondary; the activity of a graft-transmissible virus, occurring in a virulent form in the sweet orange and latent in the sour, is considered to afford the most plausible hypothesis.

Fawcett (H. S.) & Bitancourt (A. A.). **Occurrence, pathogenicity, and temperature relations of Phytophthora species on Citrus in Brazil and other South American countries.**—*Arq. Inst. biol. S. Paulo*, xi, 15, pp. 107–118, 3 pl., 1940. [Portuguese summary.]

Five species of *Phytophthora* have so far been isolated and identified from citrus in South America, viz., *P. citrophthora* (three localities in

Brazil and three in the Argentine) [*R.A.M.*, xix, p. 341]; *P. parasitica* (seven in Brazil [ibid., xix, p. 521], two in the Argentine, and one in Paraguay); *P. cactorum* (two in Brazil and one in the Argentine); *P. palmivora* (one in the Argentine, one in Uruguay, and one in Surinam); and *P. cinnamomi* (one in Brazil): this is believed to be the first record of the last-named species on citrus in any country, and it is the only *Phytophthora* causing the development of comparatively extensive lesions on sour orange. Assuming *P. citricola* to be identical with *P. cactorum*, this species under the former name has been previously isolated only in Japan [ibid., xv, p. 57] and South Africa. The isolations of *P. citrophthora* were obtained from grapefruit, sweet and sour orange, and sweet lime; of *P. cactorum* and *P. parasitica* from lemon and orange; and of *P. palmivora* from orange and tangerine.

In general, the results of inoculations into the wounded bark with *P. citrophthora* agreed with those obtained by Klotz and Fawcett in California [ibid., x, p. 98], the largest lesions developing on lemon and sweet lime, those on grapefruit, orange, and Rangpur lime being smaller, while tangerines exhibited spots of much smaller dimensions. The results of artificial infection with *P. cactorum* approximated to the foregoing, except that the lesions were generally smaller. There was less difference between the size of the spots on lemons and oranges resulting from inoculation with *P. parasitica* than in the case of the other two species used in the tests. In experiments with the same three pathogens on uninjured fruits *P. citrophthora* induced decay of all the lemons (5 or 6), oranges (3), and grapefruits (1) inoculated, while *P. cactorum* and *P. parasitica* caused rotting in only one and two or three fruits, respectively, the characteristic odour of putrescence also being most noticeable in the case of the first-named.

In tests to determine the growth relations of four of the five species (excluding *P. palmivora*) at seven different temperatures ranging from 5° to 35° C., *P. citrophthora* attained its maximum development at 24° and next at 28°, and *P. cactorum* at 28° and next at 24°; both grew slowly at 10·5° and remained stationary at 5° or 35° (the latter also at 31°). The best growth for *P. cinnamomi* was attained at 31°, closely approached by that at 28°; no growth occurred at 5°, 10·5°, or 35°. V. A. Wager in South Africa (*in litt.*, 1939) obtained results comparable to those of the writers in his subsequent experiments with transfers of the same isolates of *P. cactorum* and *P. cinnamomi*. In a test by Wager with *P. palmivora* (Argentine) the growth range extended from 13° to 37°, but the best results were obtained at 25°.

KRUG (H.). **Cafés duros. IV. Relação entre zonas, qualidade de Café e porcentagem de microorganismos.** [Hard Coffees. IV. Relation between localities, quality of Coffee, and percentage of micro-organisms.]—*Rev. Inst. Café, S. Paulo*, xvi, 169, pp. 288–295, 1 map, 1941. [English summary.]

In connexion with his studies on the relation of infection by micro-organisms to inferiority in the quality of coffee berries in São Paulo, Brazil [*R.A.M.*, xx, p. 256], the writer in 1940 made several tours of inspection of the coffee-growing regions of the State, in the course of which samples of red berries and dry fruit from the tree and from the

ground were collected and brought to the Campinas Technical Institute for study. For practical purposes, though regions of intermediate gradation do exist, the State can be divided into zones of high- and low-grade coffee production, the former including Tapiratiba, Mocóca, Batatais, Ribeirão Preto, and Franca, in which the maximum percentages recorded in any locality of *Fusarium concolor*, other fungi (notably *Cladosporium* and *Penicillium* spp.), and bacteria were 18, 31, and 3, respectively, and the latter Pindorama, Rio Preto, Valparaiso, Ipaussú, and Ourinhos, with corresponding maxima of 44, 70, and 16, respectively.

SILBERSCHMIDT (K.). **A transmissão experimental da 'mancha anular' do Cafeeiro.** [The experimental transmission of Coffee 'ring spot'.] —*Biologico*, vii, 4, pp. 93–99, 2 pl., 1 fig., 1941. [English summary.]

Experiments were conducted on a large scale in São Paulo, Brazil, to determine the conditions governing the transmission of the 'ring spot' of coffee [*R.A.M.*, xviii, p. 452] to the same host and two other locally widespread members of the Rubiaceae, *Borreria poaya* and *Richardsonia brasiliensis*. Negative results were given by attempts to transmit the virus from diseased to healthy plants by way of the seed or sap, but the approach- and side-grafting of healthy scions on severely diseased stocks induced the development of ring spot symptoms after a minimum period of ten months. In this respect the coffee disease resembles infectious chlorosis of the Malvaceae, while its symptoms are comparable to those of tobacco ring spot and citrus leprosis.

**Progress Reports from Experiment Stations, season 1939–40.**—vi+176 pp., London, Empire Cotton Growing Corporation, 1941.

These reports [cf. *R.A.M.*, xix, p. 532] contain, *inter alia*, the following items of interest. In Swaziland regular counts of cotton seedlings affected with angular leaf spot [*Xanthomonas malvacearum*] showed that seed disinfection gave good control, the untreated plots at thinning time having 30 per cent. infection, as against only 3 and under 1 per cent. for the plots treated with abavit and sulphuric acid, respectively. Two weeks later, infection in the untreated plots reached 85 per cent., while increase was negligible in the treated ones.

The season was moderately wet in Southern Rhodesia and as it succeeded one of the wettest recorded, angular leaf spot was unusually common. Locally, it is not regarded as serious, since it seldom develops beyond the primary stage. In 1940, however, infection reached the blackarm stage.

Further trials in Uganda confirmed the resistance of the B. 181 group of cotton varieties and the susceptibility of the B.P. 50 groups to wilt diseases, including those due to *Fusarium* [spp.] and *Verticillium* [*dahliae*: ibid., xix, p. 533], which are indistinguishable from each other in the field; B.P. 52 appears to come midway between these two groups in respect of resistance. P.P. 52 and Local gave conflicting results in different localities. It would appear that plants showing only internal symptoms of wilt suffer no appreciable reduction of crop, whereas those betraying external signs of the condition give a greatly diminished yield or may even be killed. The B. 181 groups possess very high

resistance to the external type but relatively low resistance to the internal. It is pointed out that it is difficult to assess the degree of attack by blackarm when plant size varies much. In the period under review, S.G. 29 was very stunted, whereas N. 17. M2 attained more vigorous growth than any other variety. As a result, N. 17. M2 was debited with a high lesion count, although it showed less severe infection than S.G. 29.

In Tanganyika Territory the cotton was attacked here and there by *Ramularia areola* [*Cercosporella gossypii*: ibid., xviii, p. 575] but without apparent loss. Confirmation was obtained that staining of cotton in Nyasaland was due to *Nematospora gossypii*, and not to *X. malvacearum*.

Rigler (N. E.) & Greathouse (G. A.). **Fungicidal potency of quinoline homologs and derivatives.**—*Indust. Engng Chem.*, xxxiii, 5, pp. 693–694, 1941.

The fungicidal potencies of isoquinoline, 13 quinoline homologues, 2- and 8-hydroxyquinoline, a nitrogen base $C_{16}H_{25}N$, and five fractions of bases from transformer-oil extract were determined against the cotton root rot fungus, *Phymatotrichum omnivorum*, at the Texas Agricultural Experiment Station [*R.A.M.*, xix, p. 592]. All the homologues were more strongly fungicidal than quinoline itself, and a tendency was apparent for toxicity to increase with molecular weight. Of the five methyl compounds tested, 6-methylquinoline was the most powerful, followed by 4-, 7-, 2-, and 8-methylquinoline, respectively. The 2, 6-dimethylquinoline was more inhibitory than the 2, 4-dimethyl compound, indicating that a substituent at position 6 is more toxic than one at 4. Of the 2, 3-dimethyl-8-alkyl compounds, the ethyl was the most, and the methyl the least toxic, the propyl being intermediate.

Of the five nitrogen bases from transformer-oil extract, the four most strongly fungicidal fractions were aromatic, the degree of toxicity increasing with the boiling-point and therefore with molecular weight. Even the least potent fraction was equally fungicidal with the most potent quinoline. The single non-aromatic fraction was slightly more toxic than the $C_{16}H_{25}N$ base.

The effect of the hydroxyl group and its position was determined by comparing 8- and 2-hydroxyquinoline, the former completely inhibiting the growth of *P. omnivorum* at 0·5 p.p.m. whereas the latter permitted it at 300. It would appear that 8-hydroxyquinoline is the most effective of any fungicide yet tested against the agent of cotton root rot.

Blank (L. M.). **Response of Phymatotrichum omnivorum to certain trace elements.**—*J. agric. Res.*, lxii, 3, pp. 129–159, 3 graphs, 1941.

When certain trace elements were added to the nutrient solution in which *Phymatotrichum omnivorum* [*R.A.M.*, xx, p. 256] was grown, it appeared that iron, manganese, and zinc were essential for optimum growth of the organism, copper had no appreciable effect at the rates of from 0·5 to 10 p.p.m. and almost completely inhibited the growth at 20 p.p.m., while aluminium, boron, cadmium, cobalt, fluorine, iodine, lithium, mercury, molybdenum, nickel, and silicon proved to be non-

essential for optimum growth both in the presence and in the absence of iron, manganese, and zinc. Aluminium and boron, however, were fairly consistent in slightly stimulating the growth of the fungus. Some of the non-essential elements, particularly nickel and cobalt, were highly toxic in concentrations above 4 p.p.m. and some, e.g., nickel, caused depression at 4 p.p.m. Copper, iron, manganese, and zinc induced better growth when added to the purified than to the standard solution. When, however, copper was entirely omitted and iron, manganese, and zinc were used in about the same ratios (2–2–2 p.p.m. being considered the optimum) the results produced in unpurified solutions were equal or superior to those obtained with purified ones. With manganese held constant at 2 p.p.m., increased concentration of zinc in relation to that of iron had an inhibiting effect on the growth of the organism in unpurified solution. Iron exerted an anomalous depressing effect at 10 p.p.m. in the unpurified solution, but this disappeared at higher concentrations. In purified solution copper was somewhat beneficial at 2 p.p.m., without effect at 5 p.p.m., and slightly harmful at 10 p.p.m. The total effect of iron, manganese, and zinc when present together was larger than the sum of their effects when added singly, indicating very important interactions.

GOLDSMITH (G. W.) & MOORE (ELIZABETH J.). **Field tests of the resistance of Cotton to Phymatotrichum omnivorum.**—*Phytopathology*, xxxi, 5, pp. 452–463, 1 graph, 1941.

Using rate of growth of *Phymatotrichum omnivorum* on decoction media made from the root system of cotton plants as a criterion in selection for resistance to the fungus the authors were able to increase resistance, the most promising selections being obtained from Native Hopi and Sudan. The average kill in the selected varieties showed a reduction from 1938 to 1939 of 26·3 per cent. The best results were obtained by selecting $F_2$ hybrids. The percentage kill in selected and non-selected representatives from a selfed variety showed that in 1939, after three selections, the final percentage for Acala was 48·9 for the selected and 94·9 for the non-selected plants, while for Delfos, Stoneville, Dixie Triumph, and Sudan the corresponding figures were 60·5 and 67·6, 46·4 and 55·8, 40 and 44·7, and 34·9 and 58·4 per cent., respectively.

AOKI (K.). **Studies on a fungus parasitic on Muscadine.**—*Bull. seric. Exp. Sta. Chosen*, ix, pp. 453–467, 1 pl., 1 fig., 1939. [Japanese, with English summary. Abs. in *Jap. J. Bot.*, xi, 2, pp. (47)–(48), 1941.]

An Ascomycete, probably a species of *Ceratostoma*, was found parasitizing the yellow muscadine, *Isaria farinosa* [*R.A.M.*, xvi, p. 532], a pathogen of the mulberry pest, *Margaronia pyloalis*, and silkworms in Japan. When *I. farinosa* was inoculated at maturity with the ascospores of its parasite, or the spores of both fungi were jointly cultured in a nutrient medium, the muscadine was overgrown by the Ascomycete which developed its perithecia. The Ascomycete was unable to attack living specimens of *M. pyloalis*, which was soon killed, however, by

*I. farinosa* in combined inoculation tests with both organisms, thereby enabling the *Ceratostoma* to develop.

RHODES (P. H.), CONANT (N. F.), & GLESNE (L. R. B.). **Histoplasmosis. Report of case in an infant 3 months of age.**—*J. Pediat.*, xviii, 2, pp. 235–241, 6 figs., 1941.

Clinical and histological details are given of a case (the fifth in an infant) of histoplasmosis (*Histoplasma capsulatum*) [*R.A.M.*, xix, p. 595; xx, p. 363, and next abstracts] in a three-months-old female child at the Children's Hospital, Cincinnati, Ohio.

CONANT (N. F.). **A cultural study of the life-cycle of Histoplasma capsulatum Darling 1906.**—*J. Bact.*, xli, 5, pp. 563–578, 3 pl., 1941.

The saprophytic filamentous form of a strain of *Histoplasma capsulatum* isolated from the blood stream of a three-months-old infant at the Duke University Hospital, North Carolina, 24 hours before death [see preceding abstract] produced on Sabouraud's agar at room temperature round or piriform, thick-walled chlamydospores, 7·5 to 15$\mu$ in diameter, covered with finger-like protuberances up to 8$\mu$ in length, but no asci. On transference to blood agar at 37° C., these organs gave rise in 10 to 14 days to the parasitic yeast-like form of the fungus, characterized by thin-walled, oval cells, 3 by 1·5 to 2$\mu$, reproducing by a single bud from the pointed end.

Howell's interpretation of *H. capsulatum* as a near relative of *Sepedonium chrysospermum* [*R.A.M.*, xx, p. 363] is accepted, with the proviso that the former, lacking a known ascigerous stage, must for the present remain among the Moniliaceae of the Fungi Imperfecti.

ANDERSON (W. A. D.), MICHELSON (I. D.), & DUNN (T. M.). **Histoplasmosis in infancy. Report of a case.**—*Amer. J. clin. Path.*, xi, 4, pp. 344–354, 6 figs., 1941.

The writers fully describe a case (the twelfth in the United States and the fifth [see preceding abstracts] in an infant) of histoplasmosis (*Histoplasma capsulatum*). A post-mortem examination of the eight-months-old female child at the University of Tennessee College of Medicine revealed widespread reticulo-endothelial hyperplasmia, the cytoplasm of the phagocytic cells of the spleen, liver, colon, and lungs containing innumerable parasites.

CRAIG (W. McK.), DOCKERTY (M. B.), & HARRINGTON (S. W.). **Intravertebral and intrathoracic blastomycoma simulating dumb-bell tumour.**—*Sth. Surgeon*, ix, 10, pp. 759–766, 4 figs., 1940.

The authors present in full detail a case of systematic pulmonary blastomycosis (*Blastomyces* [*Endomyces*] *dermatitidis*) [*R.A.M.*, xix, p. 150; xx, pp. 202, 259] in a 44-year-old farmer admitted to the Mayo Clinic, Rochester, Minnesota, in May, 1939. Cutaneous lesions were absent, the primary clinical manifestations being those of irritation of the nerve roots of the dorsal portion of the spine. The isolation of the causal organism and the consequent final diagnosis of the disease were rendered possible by the technique of rapid frozen section at the time of operation.

Turu (H.). **Über das Verhältnis zwischen der Entwicklung der Hefen und der Wasserstoffionenkonzentration der Nährflüssigkeit.** [On the relation between yeast development and the hydrogen-ion concentration of the nutrient liquid.]—*Hukuoka Acta med.*, xxxiii, 9, pp. 971–992, 2 graphs, 1940. [Japanese, with German summary on pp. 78–79.]

A fully tabulated account is given of the writer's experiments at the Dermatological Clinic of Kyushu University, Japan, on the influence of the hydrogen-ion concentration of the medium on the growth of 22 yeast-like fungi [cf. *R.A.M.*, xvii, p. 528], including *Cryptococcus hominis* [*Debaryomyces neoformans*], *D. fabrii* Ota, *D. grützii* Ota, *Myceloblastanon cutaneum* Ota and its var. Takahashi, and the thrush fungus [*Candida* (?) *albicans*], on 1 per cent. peptone water. The optimum reactions for the development of the organisms were found to range from $P_H$ 5·6 to 7. The acidity of the medium gradually increased, irrespective of the particular organism supported.

Graham (P. V.). **Solitary gummatous sporotrichosis of two years' duration: report of a case.**—*Arch. Derm. Syph., Chicago*, xliii, 5, pp. 805–808, 2 figs., 1941.

*Sporotrichum schenckii* [*R.A.M.*, xx, p. 203] was isolated on Sabouraud's agar from a solitary gummatous lesion on the left wrist of a 73-year-old man at the Louisville (Kentucky) City Hospital, apparently the first case of this particular type on record. Positive results were given by the intraperitoneal inoculation of a rat with a suspension of the fungus, which was recovered from the epididymal abscesses.

Phillips (E. W.). **Time required for the production of hay fever by spores of a newly encountered fungus, Johnson Grass smut.**—*J. Allergy*, xii, 1, pp. 24–27, 1940.

Johnson grass [*Sorghum halepense*] smut, referred by Stakman to *Sphacelotheca cruenta* or *S. holci* [*R.A.M.*, xvii, p. 453], and by R. B. Streets to *S. sorghi*, was first observed in Arizona in 1931 and by the writer in 1933, since when its distribution and prevalence are stated to have increased annually. The spores of the smut are found (as shown by gravity collections on slides) during at least eight months of the year. Extracts of the fungus elicited no positive reactions in hay-fever patients tested intradermally until the autumn of 1938; in 1939, 34 out of 131 persons, known to be sensitive to inhaled allergens and resident for at least five years in the regions of smut infestation, reacted typically to the injections. Fifteen of the positive reactors experiencing recurrences of hay fever or asthma were promptly relieved by the addition of the smut extract to their regular pollen therapy. Up to the present, the fungus has acted only as a subsidiary cause of inhalant allergy, and a minimum of five seasons' exposure to its spores was required to induce cutaneous and clinical sensitivity.

Díaz (C. J.), Lahoz (C.), & Recatero (L.). **La sensibilización a la caries del Trigo (niebla o tizón) como causa de asmas estacionales.** [Sensitization to Wheat caries (mildew or bunt) as a cause of seasonal asthmas.]—*Rev. clín. esp., Madr.*, ii, 2, pp. 135–138, 3 figs., 1941. [German and French summaries.]

Two cases are reported, one in an 18-year-old girl and the other in

a 29-year-old male from different parts of Spain, of seasonal asthma associated with allergy to the spores of wheat bunt (*Tilletia tritici* and *T. levis*) [*T. caries* and *T. foetida*], not only epidermal reactions but passive transmission being positively demonstrated in both patients. The importance of these organisms in the etiology of millers' asthma has already been shown [*R.A.M.*, xx, p. 303], and considerable interest is therefore attached to their intervention in these instances of another form of the malady. G. Villasante, working in the authors' laboratory at the Institute of Medical Investigations, Madrid, has frequently isolated bunt spores from the faeces of persons suffering from digestive allergies (unpublished observations), indicating the possible implication of *T.* spp. in disturbances of this type.

PENNINGTON (EDNA S.). **A study of clinical sensitivity to air-borne molds.**—*J. Allergy*, xii, 4, pp. 388–402, 1941.

Continuing her studies at Nashville, Tennessee, on clinical sensitivity to air-borne moulds (including *Alternaria*, *Hormodendrum*, *Aspergillus*, *Mucor*, and *Rhizopus* spp., *Monilia sitophila*, *Penicillium rubrum*, and *Cephalothecium* [*Trichothecium*] *roseum*) in asthmatic and hay-fever patients selected from the original group of 526 [*R.A.M.*, xx, p. 16], the writer demonstrated, by passive transfer, reagins to one or more of such organisms in 13 out of 18 persons. Systemic reactions to mould injections developed in 33 (7·3 per cent.) of the 526 patients. 'Provocative' tests, involving the direct application of mould spores or concentrated extracts (1 : 20) to the mucous membranes of the nose and throat, were carried out on 61 skin-sensitive patients, of whom 22 (36 per cent.) reacted positively. It is concluded that mould sensitivity is not uncommon and deserves consideration in any exhaustive study of the allergic state: children are comparatively frequent sufferers, comprising in the series under observation 9·7 per cent. of the total number of patients. [This paper was followed by a discussion reported on pp. 403–404.]

CHOBOT (R.), DUNDY (H.), & SCHAFFER (N.). **Relationship of mold reactions to clinical symptoms.**—*J. Allergy*, xii, 1, pp. 46–54, 1940.

Out of 244 asthmatic and hay-fever patients (123 children and 117 adults) tested intracutaneously at the New York Post-Graduate Medical School for their reaction to certain moulds, with special reference to *Alternaria* [*R.A.M.*, xx, p. 204], 66 (27·5 per cent.) gave positive results. Twelve of a series of 28 selected cases with positive reactions were found to be constitutionally sensitive. Cross-neutralization tests showed sensitivity to the mould to be specific. The percentages of persons in the above-mentioned series giving moderate to marked reactions in intracutaneous tests with *Penicillium*, *Hormodendrum*, *Mucor*, and *Aspergillus* were 4·2, 1·7, 2·1, and 1·2, respectively.

PARSONS (C. H.). **A visual mold test for cream, and patron reaction to it.**—*Nat. Butt. Cheese J.*, xxxii, 3, pp. 12–13, 56–69, 1941.

The writer's visual test for the detection of moulds [including *Oospora lactis*] in cream is a modification of the Wildman technique [*R.A.M.*, xx, p. 260] involving the use of a reagent consisting of 120 gm.

dry borax, 225 gm. crystalline disodium phosphate, 30 gm. sodium hexametaphosphate, 0·4 gm. medicinal methylene blue powder, and 3½ qts. soft water, 17·6 c.c. of which is added to 9 c.c. of the sample to be examined. The 2 oz. sample jar containing the cream and reagent mixture is then transferred to a water bath with a temperature of not less than 180° F., the mixture stirred for three minutes, and left for another half-minute, when the jar is removed and rotated four or five revolutions to bring the mould to the centre. The contents of the jar are next filtered through an organdie disk and the disk compared with a set of comparison standards prepared by the Research Committee of the American Butter Institute, the results being reported as good, fair, poor, and very poor. Some 8,000 samples were tested by this method over an eight-week period in the southern United States in 1940, and most of the farmers visited for the purpose showed great willingness to co-operate in its use for the elimination of mould.

Baylis (G. T. S.). **Flax wilt (Fusarium lini) in New Zealand.**—*N.Z. J. Sci. Tech.*, A, xxii, 3, pp. 157–162, 2 figs., 1940.

Instances are on record in which the agent of flax wilt (*Fusarium lini*) has persisted in the soil of plots of the Liral Crown variety for periods of four to eleven years in the Marlborough and Canterbury districts of New Zealand, where the disease has only recently been recognized. Oil varieties are in general more susceptible than those grown for fibre, but the small-seeded North Dakota 52 and 11 and the large-seeded Rio showed marked resistance in experiments involving the cultivation of 19 varieties on infected soil, with 0·7, 0·6, and 0·3 per cent. infection, respectively. The incidence of wilt among the five fibre varieties ranged from 1 to 5·6 per cent. (Stormont Cirrus and Concurrent, respectively), while the most susceptible of all varieties included in the trials were Punjab (small-seeded oil) and Moose 11/29 (large-seeded oil), with 22·8 and 19·3 per cent., respectively. Three isolates of the fungus were grown on potato extract agar and spore suspensions of the cultures inoculated into Liral Crown (fibre) and a commercial oil flax, on which they produced 4 to 22 and 13 to 27 per cent. infection, respectively, isolate No. 3 being uniformly the most pathogenic of the three. Isolates 2 and 3 were examined by W. L. Gordon, Dominion Laboratory of Plant Pathology, Winnipeg, Canada, who referred both to *F. lini*, though No. 2 is classed as a variant presenting certain anomalies (longer spores and absence of colour on potato dextrose agar and rice) suggestive of *F. conglutinans* var. *callistephi*. For the time being, attempts at control are being directed towards the selection of healthy sites and the use of disease-free seed.

Stoutemyer (V.), Hope (C.), & Close (A.). **Sphagnum for seed germination inhibits damping-off losses on unsterilized soil.**—*Nat. hort. Mag.*, xx, 2, pp. 111–120, 3 figs., 3 graphs, 1941.

Particulars are given of experiments at the United States Plant Introduction Garden, Glenn Dale, Maryland, the outcome of which showed that damping-off of ornamentals, including *Buddleia japonica*, *Mimulus lewisii* and *M. ringens*, *Sorbaria* [*Spiraea*] *sorbifolia*, *Oxydendron arboreum*, *Rhexia mariana*, and *Rhododendron*, is preventable by

the use as a medium for seed germination, instead of sand, soil, or sand-peat mixtures, of living or dried sphagnum moss, preferably with the addition of Dunlap's two-salt nutrient solution (*Circ. Conn. agric. Exp. Sta.* 129, 1939) consisting of one teaspoonful each of superphosphate and potassium nitrate per gal. water in an amount sufficient for saturation of the substratum.

LYCKÅS (C.). **Provdrivning av blomsterlökar vintern 1940–41.** [Experimental forcing of flower bulbs in the winter of 1940–41.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh., 1941*, 2, pp. 27–30, 1 fig., 1941.

Among the damaged lots of imported flower bulbs used in forcing experiments on commercial lines at the Swedish Plant Protection Institute in the winter of 1940–1 were some of narcissus infected by *Fusarium bulbigenum* [*R.A.M.*, xix, p. 539], the rotted areas being of a greyish to chocolate-brown colour and malodorous. Dead bulbs frequently bear a greyish-white or pink mycelial efflorescence. At the beginning of October 58 bulbs of Van Waveren's Giant and Pride of Hillegom were planted, taken from severely infected lots, 39 being apparently sound, 9 slightly discoloured at the base, and 10 obviously diseased. At the time of flowering in February, 49 bulbs were found to have developed normally, while nine were completely decayed. The probable incidence of infection by *F. bulbigenum* in a given stand can therefore be predicted with a fair degree of accuracy by careful selection before planting.

THIRUMALACHAR (M. J.). **Tuberculina on Uromyces hobsoni Viz.**—*J. Indian bot. Soc.*, xx, 3, pp. 107–110, 1 pl., 1941.

The author records the occurrence of a species of *Tuberculina*, tentatively referred to *T. costaricana* Syd., attacking the aecidia and pycnidia of *Uromyces hobsoni*, a parasite causing hypertrophy of the flower buds of *Jasminum grandiflorum* in India [*R.A.M.*, xix, p. 22]. The fungus forms a purple-black coating of spherical, thin-walled conidia, 8·6 by 6·8$\mu$, over the infected buds. The development of teleutosori in the infected aecidia was entirely suppressed, thereby effectually preventing the perpetuation of the rust from one season to the next by means of its resting stage.

DODGE (B. O.) & LASKARIS (T.). **Papulaspora gladioli.**—*Bull. Torrey bot. Cl.*, lxviii, 5, pp. 289–294, 2 figs., 1941.

The fungus causing the so-called smut disease of gladiolus commonly known as *Urocystis gladioli* [*R.A.M.*, xviii, p. 33] is shown to be a species of the genus *Papulaspora* and not *Urocystis* as has been hitherto assumed. That it is not a smut fungus is demonstrated by the multinucleate condition of the hyphal cells and the central and boundary cells of the bulbils; by the capacity of producing mature spore balls in culture within a week; and by the method of germination in the absence of a fusion nucleus or a promycelium. The bulbils develop on side branches of the mycelium growing more or less superficially on diseased corms. Powdery masses of the dark brown bulbils may resemble sori of *Urocystis* chlamydospores. A new combination, *P. gladioli*, is

proposed, with an amended description: the mycelium is white at first, profuse, consisting of multinucleate cells; the bulbils are borne on septate stalks and are light to dark brown in the mass, spherical, 29 to 64$\mu$ in diameter with from one to six (or more) central, dark brown, multinucleate cells surrounded by a single layer of light brown cortical cells, each with several nuclei. The bulbil primordium is a lateral branch ending in a coil. Individual cells of the bulbils germinate with simple or branched germ-tubes. In culture bulbils mature in four to ten days; conidia were not seen. Exposure to 44° C. for 30 minutes failed to kill the bulbils, so that similar treatment of the corm would not control the disease.

KEVORKIAN (A. G.) & HORN (C. L.). **The use of fungicides on Orchids.** —*Amer. Orchid Soc. Bull.*, ix, 12, pp. 328–330, 1 fig., 1941.

At the Puerto Rico Experiment Station no injury was done to orchids (*Cattleya*, *Epidendrum*, and *Oncidium* spp.) when sprayed with Bordeaux mixture 2–2–50, 4–4–50, and 8–8–50, or when cuprocide 54, cuprocide 54–Y, semesan, and ceresan were used in concentrations recommended by the manufacturers. Plants carefully inspected, severely pruned, and well sprayed remained healthy, while others, untreated, became seriously damaged by *Fusarium*, *Macrophoma*, and *Diplodia* spp. So far, 45 known and several undetermined genera of orchids have been periodically sprayed with Bordeaux mixture without injury to any plant.

PARSCHE (F.). **Lime chlorosis of Lupines.**—*Bodenk.u.PflErnähr.*, N.F., xix, pp. 55–80, 1940. [German. Abs. in *Chem. Abstr.*, xxxv, 10, pp. 3292–3293, 1941.]

In further experiments [? at Tetschen-Liebwerd, Czechoslovakia] lupins grown in 5½ kg. pots of sand with the addition of calcium chloride at the rate of 0·53 gm. calcium per pot developed chlorosis [*R.A.M.*, xv, p. 298], the affected plants being higher in water-soluble, sodium chloride-exchangeable, and hydrochloric acid-soluble calcium than normal ones grown in unlimed pots, although the hydrogen-ion concentration of the soil was not modified by the treatment. Chlorotic plants were generally lower in dry substance and contained less filterable iron in the sap than normal ones, although the total iron contents were similar or the differences were inconsistent. Infiltration experiments on chlorotic leaves showed that only iron salts were uniformly remedial, though 0·01 per cent. sulphuric acid sometimes induced a renewal of the green coloration in the foliage before death. The cause of chlorosis is thus evidently not deficiency of total iron, but its inactivation or precipitation within the leaf. The condition also resulted from the infiltration of green leaves with very dilute ammonium hydroxide or ammonium sulphate.

The hypothesis that lime chlorosis in lupin seedlings is due to the limitation of protein synthesis through the retardation of carbohydrate consumption by calcium, leading to an accumulation of ammonia, which increases the $P_H$ of the cell sap and inactivates the iron therein, was supported, but not absolutely proved, by the results of ammonia and amide nitrogen determinations in healthy, lime-, and ammonia-chlorotic foliage, and of $P_H$ soluble iron and other analyses.

HADORN (C.). **Der Schorf und seine Bekämpfung. Bericht über die Versuche im Jahre 1940, gemeinsam durchgeführt mit den Kant. Zentralstellen Oeschberg, Zürich, Arenenberg.** [Scab and its control. Report on experiments in the year 1940, conducted in co-operation with the cantonal centres at Oeschberg, Zürich, and Arenenberg.]—*Schweiz. Z. Obst- u. Weinb.*, l, 10, pp. 214–230, 2 figs., 1941.

A tabulated account is given of eight experiments in apple scab [*Venturia inaequalis*] control carried out during 1940 in climatically different parts of Switzerland [*R.A.M.*, xix, pp. 26, 263], the following being among the conclusions drawn from the tests. There was little difference between the 'simple' and 'concentrated' lime-sulphurs (22° and 32° Baumé) as regards leaf scorch; in respect of fungicidal efficacy the former proved slightly superior. Winter and summer coppers, especially the former consisting of 0·15 per cent. copper oxychloride (32 per cent.), gave somewhat better results than 0·1 per cent. iron sulphate as adjuvants to 2 per cent. lime-sulphur. Copper oxychloride dusts may safely be used for late summer treatments (August and onwards) without risk of scorching the foliage, paste preparations of the same compound being less reliable in this respect. A particularly heavy deposit is left on the foliage by the lime-sulphur-iron sulphate mixtures, thereby providing a good foundation for the lime-sulphur-lead arsenate treatments. The deposit left by the lime-sulphur-copper mixture also adheres well, while the fine bluish-grey deposit of copper oxychloride dust is regarded as specially effective against storage scab [ibid., xix, p. 710].

Discussing the application of these and other pertinent observations to the future organization of the Swiss spraying schedule, with special reference to 1941, the writer insists on the importance of the blossom treatments (2 per cent. lime-sulphur plus 0·1 per cent. iron sulphate or 0·15 per cent. copper oxychloride at the calyx stage) in April and May, when the risk of primary infections is at its height. In view of the need for economy in copper, petrol, and labour, one pre-blossom application of 3 per cent. lime-sulphur plus 0·2 per cent. copper oxychloride must suffice.

ZÄCH (C.). **Ergebnisse von chemischen Untersuchungen im Zusammenhang mit den Schorfbekämpfungsversuchen 1940.** [Results of chemical studies in connexion with the scab control experiments 1940.]—*Schweiz. Z. Obst- u. Weinb.*, l, 10, pp. 231–236, 1 graph, 1941.

In part I of this paper the writer summarizes the results of his analyses of the lime-sulphur mixtures used in the Swiss apple scab [*Venturia inaequalis*] experiments of 1940 [see preceding abstract]. All the eight samples tested fulfilled the minimum official requirement of 10 per cent. polysulphide sulphur for the 'simple' lime-sulphurs, their actual contents ranging from 11·5 to 14 per cent., the corresponding figures for the 'concentrated' mixtures (for which no minimum demands have yet been fixed) being 16·5 to 22·5 per cent. The specific gravities of the 'simple' and 'concentrated' lime-sulphurs were found to range from 21° to 24° Baumé and 26° to 32°, respectively. The

'concentrated' brands are used at a strength of only 1 per cent., in comparison with 2 per cent. for the 'simple' mixtures.

Part II deals with the arsenic content of lead arsenate-sprayed apple leaves and fruits.

EKSTRAND (H.). **Försök med borax som medel mot pricksjuka hos Äpple.** [Experiments with borax as a remedy against bitter pit of Apples.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh., 1941,* 1, pp. 6–11, 1 graph, 1941.

An account is given of experiments conducted at the Swedish Plant Protection Institute, Stockholm, and at the Svartsjö Royal Farm, in 1939 and 1940, to determine the value of borax treatments in the control of bitter pit of apples (which the author regards as synonymous with internal cork) [*R.A.M.*, xix, pp. 603, 604]. To cite some figures from the accompanying tables, the incidence of the disease developing in storage among apples from a Ribston Pippin tree receiving 250 gm. borax (strewn over an area surrounding the base corresponding to the circumference covered by the crown) was 10·6 per cent. compared with 50 per cent. for an untreated control. In another test on the Peasgood Nonesuch variety the percentage of bitter pit in the fruit from borax-treated trees at harvesting ranged from 0·5 to 7·2 per cent compared with 3·5 to 26·1 per cent. in the controls, the average amount of disease developing in storage in the two lots being 12·3 and 3 per cent. respectively.

GERHARDT (F.) & EZELL (B. D.). **Physiological investigations on fall and winter Pears in the Pacific Northwest.**—*Tech. Bull. U.S. Dep. Agric.* 759, 66 pp., 7 figs., 21 graphs, 1941.

This fully tabulated survey of the data obtained in the writers' studies from 1931 to 1935 on the physiological and biochemical changes undergone by the five chief pear varieties of the Pacific Northwest, viz., Comice, Aragon, Bosc, Flemish Beauty, and Winter Nelis, during the processes of handling, harvesting, storage, and ripening, includes observations on scald and Anjou scald [*R.A.M.*, xiii, p. 246] and core breakdown [ibid., xii, p. 102] and their control. It was noted that scalded fruits showed less oxidase and catalase activity than healthy ones, while in Comice an increase of acetaldehyde content was closely associated with both scald and breakdown, especially in fruit held at 36° as against 32° F., delayed storage after harvest being conducive to the production of abnormally large quantities of this volatile constituent. In the Comice variety loss of ripening capacity was found to be a concomitant of scald and breakdown. Pear scald, unlike the similar disorder of apples, cannot be controlled by the use of oiled paper wraps (which are, however, valuable in the case of Anjou scald); harvesting at the correct stage of maturity and immediate storage at 30° to 32° in the presence of carbon dioxide for a not unduly protracted period are important measures against both scald and breakdown.

LEACH (R.). **Banana leaf spot Mycosphaerella musicola, the perfect stage of Cercospora musae Zimm.**—*Trop. Agriculture, Trin.*, xviii, 5, pp. 91–95, 2 pl., 3 figs., 1941.

During an examination of banana leaves infected with *Cercospora musae* in Jamaica the author observed two-celled spores, apparently

ascospores, which had developed germ-tubes and appressoria similar to those of *C. musae*. Perithecia producing such spores were found without much difficulty and single ascospore isolations gave rise to cultures identical with those of *C. musae*, and yielding conidia of *C. musae* by the method of Meredith and Butler [*R.A.M.*, xix, p. 228]. Inoculations of heart leaves of Gros Michel plants with suspensions of conidia so obtained repeatedly gave rise to typical leaf spot lesions on which the conidia of *C. musae* were abundantly produced. The perfect stage, which is named *Mycosphaerella musicola* n.sp. [without a Latin diagnosis], is characterized by dark brown or black, amphigenous, erumpent perithecia, scattered on mature leaf spots, having a short protruding ostiole, a well-defined dark wall, and measuring 46·8 to 72 (mean 61·8)$\mu$ in diameter. The oblong-clavate asci measure 28·8 to 36 by 8 to 10·8$\mu$. The bicellular, hyaline, obtuse-ellipsoid ascospores measure 14·4 to 18 (mean 16·7) by 3 to 4$\mu$, are slightly wider in the upper than in the lower cell, and do not show a marked constriction at the septum except when dead. No paraphyses were noted.

At 70° to 84° F. the most rapid ascospore germination occurred in 2½ hours on plain agar. The germ-tubes nearly always grew out from both ends, though not simultaneously; they never developed from the sides. The robust hyphae, 2$\mu$ wide, grew out in line with the long axis, no side branching occurring during the first 24 hours, when the growth rate was not above 5$\mu$ per hour. Evidence of ascospore infection of banana leaves was obtained experimentally.

Ascospore discharge is not dependent on the presence of surface moisture on the leaf spots, and can take place from the lower leaves when their shaded position prevents the formation of dew, and thereby suppresses conidial production. The ascospores are also essentially wind-borne, while the conidia are readily removed from the sporodochia by water but not by wind. If there is a large population of heavily spotted leaves, ascospores may reach the heart leaves in as great abundance as do the conidia. Natural infection of a newly opened heart leaf may be as severe as that by conidia.

Ascospores may well reach the heart leaves without coming into contact with spray material, so that spraying cannot be relied upon to control this form of infection. Ascospore production and discharge appear, however, to be purely seasonal, and it would therefore seem that control would be assisted by the collection and disposal of all dead, spotted leaves before the season of ascospore discharge.

The disease was probably spread comparatively rapidly through Jamaica by means of the ascospores, as bananas are generally taken to the coast packed with infected trash leaves from which ascospores might be more easily disseminated than conidia.

[A popular account of the discovery of the ascigerous stage of *C. musae* is also given by the author in *J. Jamaica agric. Soc.*, xlv, 3, pp. 80–81, 1941.]

Uppal (B. N.), Patel (M. K.), & Kamat (M. N.). **Powdery mildew of the Mango.**—*J. Univ. Bombay*, N.S., Biol. Sci. Sect., ix, 5, pp. 12–16, 1 fig., 1941.

The causal organism of mango powdery mildew in Bombay has been

referred by Wagle to *Erysiphe cichoracearum* [*R.A.M.*, vii, p. 654], but since no description was given of the perfect stage, the authenticity of its connexion with the disease is considered dubious and the name originally applied by Berthet to the fungus in Brazil (*Oidium mangiferae*) preferred (*Bol. Agric., S. Paulo*, xv, pp. 818–819, 1914), an amplified diagnosis being given. The branched, hyaline, superficial mycelium, composed of septate hyphae, 4·1 to 8·2$\mu$ in diameter, forms a dense, white coating on the inflorescence and its stalk, and on the young fruits. Saccate or lobate haustoria (not characteristic of *E. cichoracearum*) are produced. Unicellular, hyaline, elliptical conidia, 25 to 48·9 by 16 to 23·9 (average 42·9 by 18 to 21·9)$\mu$, are borne singly, or rarely in chains of two, on erect, simple conidiophores, 64 to 163$\mu$ in length, with two or more basal cells. The optimum temperature for germination (effected by means of a germ-tube) is 22° C., with a minimum at 9° and a maximum at 30°. During the cold season, when favourable temperatures for this process prevail along the coast, the mildew may assume a destructive form.

LIN (C. K.). **Germination of the conidia of Sclerotinia fructicola, with special reference to the toxicity of copper.**—*Mem. Cornell agric. Exp. Sta.* 233, 33 pp., 2 figs., 23 graphs, 1940.

In this study on the chemical factors promoting and inhibiting the germination of the conidia of *Sclerotinia fructicola* the author found that germination does not usually take place in pure water, though occasionally a small percentage of the conidia germinate with the production of minute germ-tubes. Vigorous germination is, however, induced by the addition of a small amount of a carbohydrate or of ethyl alcohol. When the density of the spores is about 35,000 per c.c., an increase in the concentration of the dextrose or of the ethyl alcohol up to 0·1 mg. per c.c. increases the percentage germination. At a concentration of 0·01 mg. per c.c. more spores germinate in alcohol solution than in dextrose solution. In the presence of a sugar, the spores also germinate under anaerobic conditions, while in the absence of oxygen ethyl alcohol does not induce germination. In these cases energy supply appears to be the limiting factor in germination.

In a pure dextrose or alcohol solution germination is very variable, the percentage seldom exceeding 90; when a little magnesium sulphate is added, germination invariably reaches 95 to 100 per cent. At a concentration of 0·1 millimol per l. magnesium chloride, magnesium nitrate, calcium sulphate, calcium chloride, and basic potassium phosphate also increased percentage germination. Both 0·01 and 100 millimolal calcium chloride or magnesium nitrate promote spore germination and germ-tube elongation, but exercise an inhibiting effect at 1 millimol per l. concentration. With aluminium chloride inhibition is greatest at 0·01 millimol per l., being lower above and below this concentration. It is apparent that the effect of these salts is not due to their function as nutrients, and it is suggested that there may be a relation between the colloidal effect of the electrolytes and spore activity.

In a pure dextrose solution the lethal dosage of copper is about 10 to 100 times lower than has previously been reported. The smallest

number of copper atoms required to inhibit the germination of one spore is estimated at about ten billion.

Electrolytes act as antidotes to copper toxicity and promote germination, the data indicating that their effectiveness in this respect depends upon the concentration and valency of the ions and upon the $P_H$.

If it is assumed that copper precipitates certain cell colloids, the antidoting effect of electrolytes would appear to result from peptization of the precipitated colloids. This view is supported by the fact that electrolytes induce the germination of spores already poisoned by copper. The primary toxic action of copper does not seem to kill the spores, but prolonged copper treatment causes gradual loss of germinability of the spores in an electrolyte-dextrose solution, probably owing to an irreversible harmful process distinct from the primary toxic action of the copper. Apparently, the poison and the antidote cause spore inactivation and reactivation, respectively, as the normal cell functioning depends on the colloidal condition of the cell protoplast.

Dunlap (A. A.). **Plant diseases in Texas and their control.**—*Circ. Tex. agric. Exp. Sta.* 91, 70 pp., 30 figs., 1941.

This booklet presents in a clear and readily intelligible form the accumulated results of many years' research on the control of the principal diseases of economic crops in Texas.

Neergaard (P.). **Seed-borne fungous diseases of horticultural plants.**—*C.R. Ass. int. Essais Semences, 1940,* 1, pp. 47–71, 1940.

This is a useful survey of the principal diseases of horticultural plants, embodying information on their distribution, incidence of seed infection, and economic importance in relation to the crop. A table shows the methods of seed-testing employed for the demonstration of different groups of fungi, and a six-page bibliography is appended.

**New and promising varieties recently described in the literature.**—6 pp., Cambridge, Imp. Bur. Pl. Breed., 1941. 1*s.* 0*d.*

A list is presented in tabular form of potentially valuable, recently developed varieties of important agricultural crops, incorporating the Latin and varietal names, qualities (including reaction to major diseases), addresses from which further information may be obtained, and origin.

Lubishtsheff (A. A.). Об определении вредоносности методом искусственных повреждений. [On the determination of injuriousness by the method of artificial injury.]—*J. Bot. Acad. Sci. Ukr.*, i, 1, pp. 159–188, 1940. [English summary.]

This is a critical review of work on the effect of experimental mechanical injury (such as the removal of leaves or parts of leaves) on plant growth undertaken with the object of correlating such injury with that caused by diseases and pests. The author concludes that the potential value of this technique has been greatly overestimated and that the method is at best only auxiliary to direct field investigations.

Snow (A. G.). **White Pine propagation.**—*J. For.*, xxxix, 3, pp. 332–333, 1941.

In nearly all cases in which white pine [*Pinus strobus*] cuttings have

taken root at the North-Eastern Forest Experiment Station, the rooting medium (a sand-peat mixture 3 : 2, previously used for the same purpose and containing many partially decomposed needles) was infected by several species of fungi. In the absence of direct experimental proof it is surmised that these organisms may exert a beneficial effect on propagation, either by acting as a supplementary source of natural auxins, which have been found to assist in the rooting process, or in a symbiotic capacity.

CHAUDHURI (H.) & QURAISHI (A. R.). **A study of the fungal endophyte of some Anthoceros erectus Kashyap.**—*Proc. Indian Acad. Sci.*, xiii, 4, pp. 255–260, 1 pl., 1941.

The thalli of specimens of the liverwort, *Anthoceros erectus* [cf. *R.A.M.*, xv, p. 179], from Mussoorie were found to contain an endophyte in all parts but more generally in the basal region, characterized by hyphae of two kinds (*a*) thin-walled, not distinctly septate, 3·5 to 5·4$\mu$ in diameter, and (*b*) septate, 6$\mu$ in diameter, occasionally forming knots and often swollen at the tips. Infected plants are dwarfed and fail to produce sporogonia of normal size. On potato glucose agar the endophyte forms light brown, branched, septate hyphae, 2·8 to 8·5$\mu$ in diameter, intercalary or lateral chlamydospores of very variable dimensions (average 7 to 9$\mu$ in diameter), and thick, dark-coloured sclerotia, 310 by 260$\mu$.

MARSH (R. W.) & MARTIN (H.). **Simplified methods of Potato blight control: Progress report I—spraying methods.**—*Rep. agric. hort. Res. Sta. Bristol, 1940*, pp. 63–75, [1941].

In order to find a simple method of spraying potatoes against *Phytophthora infestans* suitable for use in private gardens and allotments, tests were made at a number of centres in the Bristol advisory province during 1940 with a watering can fitted with a fine rose and a variety of compounded copper fungicides employed in comparison with Bordeaux and Burgundy mixtures.

The results obtained showed that sprinkling from the can was much quicker and easier than spraying with a 'Solo' bucket pump, except with Bordeaux mixture, which choked the holes of the rose. The amount of spray needed in sprinkling was not more than that required when spraying. Though the weather was unfavourable to infection, the evidence indicated that sprinkling will effect control even when no attempt is made to cover the under side of the leaves. The deposit left by sprinkling was as much as that left by spraying, except when the applications were made before full haulm development. There was no indication that the deposit left by sprinkling was lacking in tenacity. The deposit from the compounded products was slightly less in quantity than that left by Bordeaux mixture when equal amounts of spray of the same copper content were applied, possibly owing to the less perfect dispersion of the compounded products.

HICKMAN (C. J.). **Simplified methods of Potato blight control: Progress report II—dusting methods.**—*Rep. agric. hort. Res. Sta. Bristol, 1940*, pp. 76–79, [1941].

In further tests to find a simple method of controlling potato blight

[*Phytophthora infestans*] in private gardens and allotments [see preceding abstract], comparative trials were made with a home-made dust distributor, consisting of a cylindrical tin measuring 6 by 4 in. with holes $\frac{1}{25}$ in. in diameter drilled about $\frac{1}{4}$ in. apart in one end, which was covered with a piece of fine muslin held in position by means of a rubber band, and a hand-operated rotary blower made by the Niagara company. The dusts used were copper sulphate monohydrate and cuprous oxide (cuprocide GA), both made up to contain 15 per cent. by weight of copper. No information on blight control was obtained as the disease did not appear, but the results showed that initial retention of dust was greater in the plots dusted with the home-made apparatus. Three disadvantages, however, were attached to the hand-made duster: it took longer than the blower to apply a given amount of dust, a relatively small proportion of the dust reached the under surface of the leaves, and a larger proportion of leaves remained virtually untreated.

KLAUS (H.). **Untersuchungen über Alternaria solani Jones et Grout, insbesondere über seine Pathogenität an Kartoffelknollen in Abhängigkeit von den Außenfaktoren.** [Investigations on *Alternaria solani* Jones & Grout, with special reference to its pathogenicity in Potato tubers as dependent upon external factors.]—*Phytopath. Z.*, xiii, 2, pp. 126–195, 9 figs., 5 graphs, 1 map, 1940.

In cultural studies conducted over a number of years at Dahlem, Berlin, isolates of *Alternaria solani* [*R.A.M.*, xviii, p. 474] from various sources were found to vary in their capacity to form spores and to produce pigment, in their sensitivity (the tendency to interruption of the normal growth of the mycelium), and in the size of the spores. Infection was obtained artificially in both sound and wounded potato tubers. The former were most susceptible to infection just after harvest, indicating that infection of unwounded tubers in storage need hardly be expected. In varietal trials, Frühmölle was more susceptible than Erstling [Duke of York] and Spaulding Rose; in the last-named variety, however, the lesions expanded in some cases more rapidly than in the other two.

Temperature and humidity proved to be limiting factors for mass spore production, the optimum conditions prevailing at 26° C. and 100 per cent. relative air humidity. The exact optimal temperature was established *in vitro* as 26·1°, with a minimum at 1·5° and a maximum at 34·5°. Light and carbon dioxide content of the air were of less importance: very weak light intensities of about 200 Lux were sufficient for spore formation, which was inhibited only by complete darkness and concentrations of carbon dioxide of over 0·5 per cent. Although an air humidity of 100 per cent. proved optimal for the growth of the mycelium, a range of from 34 to 100 per cent. did not influence the spread of the fungus in the tubers. The water content of the tuber seemed also without effect. It was found that an osmotic pressure of 130 atmospheres is necessary to arrest the growth of the fungus, and since the osmotic capacity of the potato sap reaches its maximum at 11 atmospheres, it can have no effect upon the spread of the fungus in the tuber. Carbon dioxide concentrations above 0·5 per cent. were harmful to mycelial growth *in vitro*, but 12 per cent. failed to exercise

a marked effect on the spread of the fungus in the tuber. Lowering the oxygen content to 2 per cent. had no inhibiting effect upon the mycelial growth in pure culture, the only visible effect being a lighter colouring of the hyphae. The development of the fungus in the tuber was arrested by lowering the oxygen content to below 10 per cent., so that changes of the oxygen content likely to occur in storage are without effect. A correlation depending above all upon temperature was found to exist between wound cork formation and the spread of the fungus in the tuber, the optimal temperature for the development of the disease being 14·5° to 17°. The humidity and the oxygen content of the air have also an effect on the wound cork formation, but not on the spread of the disease.

Most of the strains of *A. solani* encountered in Germany are of a comparatively weak pathogenicity and the losses caused by the disease are, therefore, likely to be less serious at first than in America. As a measure of control early potatoes should be left to mature well in the ground, and contact between tubers and foliage avoided.

McIntosh (T. P.). **The spread of black leg in Potato stocks.**—*Gdnrs' Chron.*, Ser. 3, cix, 2837, p. 184, 1941.

In this paper the author adduces evidence in support of the view that outbreaks of potato blackleg [*Erwinia phytophthora*] may be due to infection from contaminated soil. In the first place, it has never been suggested that the disease is transmissible through true seeds, and during twenty years' experience the author has never seen the disease in the first years of the lives of certain varieties, such as Arran Consul, the stocks of which now contain a high percentage of infection. The organism must therefore have gained entrance to the stock other than by planting diseased setts. On one occasion, the writer, in growing 2,000 first-year seedlings, counted about 3 per cent. infection. Further, in building up virus-free stocks of certain varieties, he found that the progeny of apparently healthy plants may produce crops during the following year with 10 per cent. or more infection. In many instances, incidence has been higher in tubers from apparently healthy plants than in those from affected ones. On the other hand, tubers from diseased plants, if planted in good soil, seldom reproduce the disease the next year. In one small experiment, tubers were cut into two, one piece of each being planted in a dry, and the other in a wet, locality. Infection was later negligible in the former place, but reached 13 per cent. in the latter. On another occasion, the author observed across a valley a clear line of discoloured potato foliage; it was observed that the upper part of this line began below a spring, the discoloured foliage throughout the line being entirely due to blackleg; in the rest of the field the disease was negligible. In investigating complaints from farmers about blackleg attributed to bad seed the author frequently noted that one stock was infected while another from the same seed source was not. Very few outbreaks were, in fact, traced to infected seed.

Injury to the haulm, such as that which occurs when plants are trampled on, doubtless provides the organism with a means of ingress to the plant. Cutting the seed setts also increases the disease. Incidence,

however, is always highest in wet soil, and cut seed should never be planted in such soil. The first means of control is drainage.

RAMSEY (G. B.). **Botrytis and Sclerotinia as Potato tuber pathogens.**—*Phytopathology*, xxxi, 5, pp. 439–448, 2 figs., 1941.

*Botrytis cinerea* was isolated from rotted Bliss Triumph potato tubers [*R.A.M.*, xiii, p. 322] received at the Chicago market from California in January, 1938, following several months' storage, some 5 per cent. being affected by the brown, watery decay characterizing the advanced stage of infection, and 9 per cent. by the incipient dry phase, consisting of sunken, pitted, discoloured areas penetrating $\frac{1}{8}$ to $\frac{1}{4}$ in. into the flesh; two days later the same lot showed 35 per cent. rot, the typical greyish-brown spores of the causal organism being present on the tuber surface in the later stages of disintegration.

In inoculation experiments with the mycelium of *B. cinerea* on wounded Bliss Triumph and Irish Cobbler tubers, a strongly pathogenic effect was exerted on those held at 40° F. in an atmosphere of extreme humidity, whereas at 70° decay seldom resulted, indicating that at the latter temperature suberization and wound periderm formation usually occur with sufficient promptitude to bar invasion by the fungus. A longer period than three days at 70° was, however, necessary for the formation of enough periderm to withstand subsequent exposure to a colder atmosphere. Freshly injured tubers sprayed with a suspension of *B. cinerea* spores in sterile water developed the characteristic water decay at 40° but not at 70°, despite the profuse mycelial growth over the diseased areas at the latter temperature.

Inoculation tests on Bliss Triumph tubers with *Sclerotinia sclerotiorum*, *S. intermedia*, and *S. minor*, resulted in appreciable infection by the last-named at 70°, while *S. intermedia* was the principal agent of decay at 40° and 32°.

Wounded control tubers held at 40° under very humid conditions underwent slight suberization but formed no wound periderm within a month, whereas those maintained at 70° revealed extensive suberization and wound periderm formation within three days, suggesting that the risk of decay through wound infections from the sources under observation may be greatly reduced by keeping potatoes under conditions of moderate temperature and humidity for three or more days after harvesting.

BELOVA (Mme O. D.). Кольцевая гниль Картофеля и меры борьбы с ней. [Ring rot of Potato and its control.]—*C.R. Pan-Sov. V. I. Lenin Acad. agric. Sci., Moscow, 1940*, 19, pp. 21–26, 3 figs., 1940.

Ring rot of potatoes caused by *Bacterium sepedonicum* [*R.A.M.*, xx, p. 273] is stated to be widespread in the central and northern parts of the U.S.S.R. [ibid., xv, p. 251]. In the dry, southern districts the disease is observed in appreciable amounts only on imported potatoes and gradually disappears when these are propagated locally. The losses in yield caused by the disease in the field amount to between 20 and 40 per cent., and during storage to between 50 and 60 per cent. Experiments conducted in the Ukraine showed that the disease is carried in

the tubers, and is not transmitted by soil. In 1937, at the Institute of the Potato Industry, a form of rot, hitherto undescribed, was observed on several varieties severely attacked by ring rot. In the early stage this form, to which the name hollow rot is given, can only be detected after peeling off the skin, when small, roundish, cream-coloured, soft spots can be seen often surrounded by a more translucent, but still firm zone. Later the spots enlarge, the skin splits, and a cavity is exposed. Bacteriological analysis of hollow rot material revealed the presence of *Bact. sepedonicum*. In inoculation experiments during 1938 injured tubers were successfully infected at all seasons while uninjured ones became infected only when inoculated at harvest time, the greater susceptibility displayed at this period being attributed to the very thin skin and open eyes of the tuber at that time. Essential for successful inoculation was sufficient moisture in the tuber. At harvest time healthy tubers become contaminated through contact with diseased ones, or with contaminated containers, tools, and hands of labourers. Potatoes harvested in 1937 during the rainy season developed 23 to 50·5 per cent. hollow rot infection as compared with 0 to 2 per cent. in those harvested during dry weather in the following spring. The percentage of hollow rot and ring rot infection in tubers stored in a moist state was 20 and 7, respectively, as compared with 0 and 1, respectively, in those dried before storage for six hours. For the control of the two rots it is essential that diseased plants be removed from the field, harvested tubers dried before storing, and knives used for cutting seed potatoes disinfected before use.

Heinze (K.) & Profft (J.). **Über die an der Kartoffel lebenden Blattlausarten und ihren Massenwechsel im Zusammenhang mit dem Auftreten von Kartoffelvirosen.** [On the species of aphids inhabiting the Potato and their mass migration in relation to the development of Potato viruses.]—*Mitt. biol. Anst.* (*Reichsanst.*), *Berl.*, 60, pp. 1 *et seq.*, 1940. [Abs. in *Züchter*, xiii, 3, p. 72, 1941.]

The only one of the potato-inhabiting aphids of any practical importance as a vector of viruses in Germany is stated to be *Myzodes* [*Myzus*] *persicae* [*R.A.M.*, xviii, p. 132], though *Aulacorthum* [*M.*] *pseudosolani* may occasionally be implicated in the transmission of leaf roll. Studies on the mass migration of the potato aphids were conducted at Dahlem, Berlin, representing a locality where the crop is prone to degeneration, and at Dramburg, East Pomerania, where the breeding of superior stocks for seed is practised. The multiplication of the insects was found to be favoured by periods of fair weather, especially during April and from May to mid-July. High winds bring the aphids out of their winter quarters, while light, dry breezes promote their movement from plant to plant. The disastrous early infestations by *M. persicae*, involving the whole plant, were less prevalent at the Pomeranian breeding station than in the Berlin district owing to the relatively late appearance and dispersal of the aphids at the former site. Both winged and wingless aphids participate in the transmission of late infection.

In connexion with the overwintering habits of *M. persicae*, the writers recommended at least one dormant spraying of peach and apricot trees. The use of high-grade, healthy seed, timely elimination

of diseased plants, the cultivation of superior stocks in elevated situations, and the use of nicotine sprays are also advocated.

LOUGHNANE (J. B.). **The susceptibility to leaf roll of certain Potato varieties and its effect on their yield.**—*J. Dep. Agric. Éire*, xxxviii, 1, pp. 48–67, 3 figs., 1941.

After discussing some recent contributions to the literature of potato leaf roll and noting the symptoms of the disease as they appear on a number of the newer potato varieties, the author describes in detail two experiments carried out in Eire in 1937 and 1938 in which healthy tubers of different varieties were grown in a field adjoining a market garden in which winter cabbages had been planted, and were exposed to natural infestation by *Myzus persicae* [see preceding abstract].

The results obtained indicated that the most susceptible of the varieties tested were Arran Cairn, Up-to-Date, and Arran Signet, while Arran Pilot, British Queen, Kerr's Pink, Gladstone, Arran Peak, Arran Victory, Dunbar Yeoman, Ulster Monarch, May Queen, President, Great Scot, Arran Crest, Epicure, Redskin, and Dunbar Standard were intermediate, and Flourball, Arran Banner, and Majestic were least affected. Yield was reduced by at least 80 per cent. in King Edward, President, May Queen, Arran Crest, Arran Pilot, Arran Signet, Redskin, and Dunbar Yeoman, by between 50 and 80 per cent. in Epicure, Arran Cairn, Dunbar Standard, Ulster Monarch, Arran Banner, Eclipse, Gladstone, Arran Peak, British Queen, Kerr's Pink, and Arran Victory, and by 50 per cent. or less in Up-to-Date, Great Scot, Majestic, and Flourball.

The evidence demonstrated that the effect of the disease on yield is directly proportional to the effect on vigour. On the whole, early varieties all showed serious reduction of yield when attacked; in main-crop varieties there was wide variation in the effects on vigour and yield, but serious loss of yield followed extreme reduction of vigour.

In the two years of the test, initial infestation by *M. persicae* took place on 13th and 12th May, respectively, and maximum infestation about mid-June and towards the end of May, respectively. The period during which most primary leaf roll developed appeared to be related to the date of maximum infestation by the vector. It was also found that even when vectors and sources of leaf roll are present in a potato crop in rather large numbers, there is a significant difference in the extent of the spread of the disease to healthy plants growing at varying distances from the source of infection, healthy plants in close proximity to the source being more likely to become infected than those removed from it by a distance of one or two drills. It would, therefore, appear that in any single potato crop the chief vectors are the apterous aphids.

GULYÁS (A.). **Sejttani tanulmány a virusbeteg Burgonyákon és a környezet tényezöinek hatása a virosokra.** [A cytological study of virus-infected Potatoes and the influence of environmental factors on the vines.]—*Mag. Gazdas. Akad. Munkai*, ii, 1, pp. 118–136, 1939 (1940). [Abs. in *Biol. Abstr.*, xv, 5, p. 1001, 1941.]

In further studies on the virus diseases of potatoes in Hungary [*R.A.M.*, xvii, p. 619], the writer found that the Y virus moves at

the rate of 6 to 8 cm. in 3 to 4 days, the X virus more rapidly, and that of leaf curl covers 25 to 30 cm. in 8 to 12 days. An examination of fixed material revealed spherical or elliptical X-bodies, 3 to 25$\mu$ in diameter, in various parts of Y- and crinkle-infected plants, a diseased cell usually containing one such element, though two or three were occasionally present. In certain infected cells, particularly those in proximity to X-bodies or vacuolated cells, 8 to 12 green granular bodies developed, giving a plasmodium-like appearance. In such cells the chloroplasts turned dark, yellow, or pale yellow-green with a consequent disturbance of their normal functions.

KÖHLER (E.). **Das Tabak-Ringspot-Virus als Erreger einer Gelbfleckigkeit des Kartoffellaubes.** [The Tobacco ring spot virus as the agent of a yellow spotting of Potato foliage.]—*Angew. Bot.*, xxii, 6, pp. 385–399, 15 figs., 1940.

Three strains of the tobacco ring spot virus were isolated from potatoes affected by a yellow spotting of the foliage in Germany, viz., (1) from a single plant of a stand comprising 50 plants of the Edelgard variety, designated 'Ede'; (2) from a plant of a Pomeranian selection ('Po'); and (3) from several plants of the Frühmölle variety ('Früh'). The last-named spreads freely through stands of Frühmölle and is also readily transmissible through the tubers to the progeny of diseased plants. The type of spotting on this variety was of a strikingly large pattern agreeing in all essentials with the North American calico [*R.A.M.*, xix, p. 563], though obviously caused by a different virus: on Edelgard and the Pomeranian selection the symptoms resembled those of aucuba mosaic.

The effects of inoculation with the three potato strains on Turkish tobacco (Samson and Xanthia) were at first inconspicuous, but gradually acquired the intensity of a characteristic severe attack of ring spot. Only a few of the cucumber plants inoculated by rubbing with the three ring spot strains developed systemic infection, though all reacted by the formation of pale green spots of the needle-prick type [ibid., x, p. 60]. The 'Ede' and 'Po' strains (Früh was omitted from this series of tests) produced quite divergent symptoms on bean (*Phaseolus vulgaris*) leaves, those due to the former consisting merely of isolated sunken, necrotic spots, while the latter caused the formation of numerous circular, reddish-brown, necrotic zones, followed by shedding of the inoculated leaves and in some cases by the brown discoloration of the stem and ultimate collapse of the plants. Extensive necrotic lesions, merging into chlorotic patches, and succeeded by a prominent yellow mosaic spotting, developed on inoculated *Nicotiana glutinosa* leaves. Chilli (*Capsicum annuum*) leaves reacted to the virus (especially the 'Po' strain) in an unusual and interesting manner, the delayed necrosis involving the petioles, leaf blades, and veins being apparently directly due to a toxin formed in response to the invasion of the stem apex by the virus, thus presenting an analogy with the 'defensive reactions' described by the author in *Mitt. biol. Anst.* (*Reichsanst.*), *Berl.*, 59, pp. 25 *et seq.*, 1939.

The thermal death point of the 'Ede' and 'Po' strains of the ring spot virus was found to be 63° C., 'Früh' tending to be slightly more

resistant. The two first-named strains were still infective at dilutions of 1 : 100 but not at 1 : 1,000, in agreement with Price's ring spot virus strain No. 2 [*R.A.M.*, xv, p. 831]; in this respect also Früh showed more resistance, causing slight infection at 1 in 1,000 and an occasional trace at 1 in 10,000, these data corresponding to those obtained with Price's strain No. 1 [loc. cit.]. Inoculation with the 'Früh' or 'Po' strains was experimentally shown to protect Samson tobacco plants against subsequent infection by 'Ede', 'Früh' likewise conferring immunity from cucumber mosaic.

TULLIS (E. C.). **Diseases of Rice.**—*Fmrs' Bull. U.S. Dep. Agric.* 1854, 17 pp., 14 figs., 1940.

Popular notes are given on the distribution, symptoms, etiology, life-history of the causal organisms, and control of the following rice diseases, with special reference to conditions prevailing in the United States: white tip, apparently due in part to alkaline soil, brown spot (*Helminthosporium oryzae*) [*Ophiobolus miyabeanus*], blast (*Piricularia oryzae*), narrow brown leaf spot (*Cercospora oryzae*) [*R.A.M.*, xix, p. 301; xx, p. 222], brown-bordered leaf spot (*Phyllosticta glumarum*) [ibid., vii, p. 143], leaf smut (*Entyloma oryzae*) [ibid., xv, p. 255; xix, p. 301], bordered sheath spot (*Rhizoctonia oryzae*) [ibid., xviii, p. 616], *R.* [*Corticium*] *solani* [loc. cit.], and *R. zeae* [ibid., xvii, p. 623]), black sheath rot (*O. oryzinus*) [ibid., xiv, p. 124], reddish-brown sheath rot (*Helicoceras oryzae*) [ibid., xvi, p. 491], stem rot (*Leptosphaeria salvinii* and *Helminthosporium sigmoideum* [var.] *irregulare* [ibid., xviii, p. 815; xx, p. 381]), kernel spots (*Curvularia lunata* [ibid., xix, p. 492] and *Trichoconis caudata* [ibid., xix, p. 493]), kernel smut (*Tilletia horrida*) [ibid., xix, p. 301], and straighthead [ibid., xx, p. 222].

Crab grass (*Digitaria sanguinalis*) has been found to serve as a host of *Piricularia oryzae* [cf. ibid., xv, p. 426] while cattail (*Typha latifolia*) carries *O. oryzinus* through the winter. This organism, occurring in Arkansas and Louisiana, is stated to be present also in Italy. *Phyllosticta glumarum* is said to occur on rice in Arkansas, Louisiana, and Texas as well as in the Philippines and Japan, but has never been found to cause any great amount of damage.

KALINENKO (V. O.). **Bacteriosis of vessels in the xylem of Koksaghyz root.**—*Microbiology*, ix, pp. 295–299, 1940. [Russian, with English summary. Abs. in *Chem. Abstr.*, xxxv, 10, pp. 3379–3380, 1941.]

In numerous plantations of the U.S.S.R. the roots of the valuable rubber- and latex-producing kok-saghyz (*Taraxacum kok-saghyz*) are infected by bacteria entering through the lower leaf stalks, the neck of the root, and the side roots. In the root these organisms, which are introduced by soil nematodes [*R.A.M.*, xvi, p. 123], form mucous masses occluding the lumen of the vessels. During the first year, an average of 10 per cent. of the plants contract infection, which increases to 50 per cent. in the second season of cultivation, especially in humid localities; at this stage the parenchymal tissues become susceptible owing to lowered immunity. The disease may be combated by frequent applications of Bordeaux mixture or limiting the cultivation period to one year.

Stockberger (W. W.). **Ginseng culture.**—*Fmrs' Bull. U.S. Dep. Agric.* 1184, 17 pp., 7 figs., 1941.

The section of this bulletin dealing with ginseng (*Panax quinquefolium*) diseases in the United States (pp. 9–14) comprises popular notes on the symptoms, etiology, and control of root rot and blight (*Alternaria panax*) [*R.A.M.*, xvii, p. 447], mildew and root rot (*Phytophthora cactorum*), *Acrostalagmus* wilt, white and black *Sclerotinia* rots (*S. sclerotiorum* and *S. smilacina* Dur. = *S. panacis* Rankin) [ibid., ii, p. 503], the latter also occurring on *Smilacina racemosa*, damping-off of seedlings due to miscellaneous fungi, and *Ramularia* root rot [? *R. destructans*: ibid., xiv, p. 393; xv, p. 117].

Méndez (R.). **Estudio sobre un daño fungoso del Ajonjolí en Costa Rica.** [Study on a fungous disease of Sesame in Costa Rica.]—*Bol. Cent. nac. Agric. S. Pedro*, v, 9–12, pp. 426–432, 1 fig., 1940.

Sesame plantings in Costa Rica have been attacked by a destructive disease attributed by the writer (in consultation with the United States Department of Agriculture) primarily to infection by *Alternaria solani*, with *Helminthosporium sesami* [*R.A.M.*, xii, p. 660] as a secondary invader. The lesions gradually investing the entire plant from the base upwards to the new leaves correspond with those commonly produced by the former organism on potatoes and tomatoes in the affected zones. Excessive atmospheric and soil humidity appears to be the chief contributory factor in severe outbreaks of the leaf spot, and control should be based in the first place on the selection of ecologically appropriate sites, supplemented by such cultural measures as the use of healthy seed (treated with a standard fungicide) of resistant, early maturing varieties of medium stature, sowing in rows and not at random, and the application of Bordeaux mixture at three- to four-weekly intervals, beginning when the plants reach a height of 20 to 30 cm.

Martin (J. P.). **Pathology.**—*Rep. Hawaii Sug. Exp. Sta., 1940* (ex *Proc. Hawaii Sug. Pl. Ass., 1940*), pp. 22–36, 1941.

In this report [cf. *R.A.M.*, xix, p. 432] it is stated that sugar-cane Fiji disease was reported, by F. X. Williams, for the first time from New Caledonia in August, 1940, one of the vectors, *Perkinsiella* sp. [? *P. vastatrix*] also being found. Only one infective leafhopper is necessary to transmit the disease to healthy sugar-cane, and with faster aeroplanes and more frequent trans-Pacific trips, the risk of introducing disease-carrying insects is increasing.

The mosaic situation is stated to be very satisfactory, owing to the planting of resistant varieties, the use of healthy planting material, weed control, and roguing. The strain of sugar-cane mosaic found in Hawaii is of very low virulence, and is difficult to transmit as compared with the other strains known, which amount to at least ten.

Leaf scald [*Bacterium albilineans*: ibid., xix, p. 432] is very serious in some parts of Hawaii, and is increasing. In Puna, Hawaii, the disease was very severe on Yellow Caledonia in localized areas in many fields. Usually, it occurred in its chronic phase, though in many instances the acute phase, characterized by sudden wilting and drying of the plant,

was noted. The outbreak was associated with very dry weather before and during summer.

A table is given showing the tolerance of the chief sugar-cane varieties grown in Hawaii towards the major diseases, eye spot, brown stripe [*Cochliobolus stenospilus*: ibid., xx, p. 178], leaf scald, chlorotic streak, mosaic, and *Pythium* root rot [*P. graminicolum*: ibid., xvi, p. 561].

It is stated that in the field banded chlorosis [ibid., xvi, p. 561] supervenes after low temperatures; it can be produced artificially by putting an ice pack round the central spindle of a growing plant. In studies by C. G. Lennox in which sugar-cane varieties were exposed to a temperature of 130° F. for five hours, well-defined horizontal bands of chlorotic to white tissue appeared on the leaves some days later. This is the first occasion in Hawaii when the condition has been produced by heat.

The distribution of chlorotic streak in Hawaii [ibid., xix, pp. 432, 729] is associated with regions of high rainfall, especially where poor drainage results in abnormal growth; growth generally responds to potash applications in these places. Severity is thought to be correlated with potassium deficiency. For control purposes, resistant varieties should be planted, only healthy planting material used, doubtful material submitted to hot-water treatment [ibid., xx, p. 178], and roguing practised, particularly in seed nurseries.

In an experiment in which untreated cuttings and hot-water treated cuttings, both affected with chlorotic streak, were planted in the field, the treated plots outyielded the untreated by 15·5 tons of cane and 1·5 tons of sugar per acre. As a result of another test, the varieties grown locally are tabulated according to the tolerance shown to chlorotic streak. The disease was also transmitted for the first time by artificial inoculation to healthy canes. Healthy plants of P.O.J. 2878 and 31–2806 were inoculated, respectively, with a plant extract prepared from diseased cane plants and two waters (ditch and surface) from a locality where the disease is common. Every plant was inoculated near the growing point by needle-prick, and was grown in complete, aerated, nutrient solutions. Inoculations were made on 21st and 22nd December, 1939, and the first symptoms were noted on 15th February, 1940. Of 18 plants inoculated, 7 developed the disease. In studies by [C. W.] Carpenter the disease was on several occasions transmitted from affected to healthy plants growing in a culture solution in the same container, the disease developing on the healthy plants in about six months. Symptoms resembling those of chlorotic streak have been found on *Pennisetum purpureum* and *Coix lacryma-jobi*, which are frequently found growing very near sugar-cane. Carpenter has also reported the presence of a Chytrid on *P. purpureum* similar to that found by him on sugar-cane [ibid., xx, p. 276].

During the past five years marked progress has been made in Hawaii in eye spot (*Helminthosporium sacchari*) [ibid., xix, p. 432] control by planting resistant varieties in localities where environmental conditions strongly favour the disease. A promising new technique has been devised for the inoculation of sugar-cane leaves with the spores of *H. sacchari*. Leaves of uniform age are carefully removed and laid on several layers of moistened cloth. The spores are then sprayed on to

the upper and lower surfaces of the leaves, which are covered with more layers of damp cloth, and then with a layer of waxed paper. The leaves thus remain damp for a fortnight, permitting infection and the production of fresh spores.

Elephant or Napier grass (*Pennisetum purpureum*) eye spot, due to *H. ocellum* [ibid., xvii, p. 753; xx, p. 350], is now present on all the Hawaiian islands, and is frequently very serious. The fungus differs culturally and morphologically from *H. sacchari*. In one test sugar-cane leaves sprayed with *H. ocellum* spores developed lesions similar to those caused by *H. sacchari* on very resistant varieties, while in another test little or no infection was produced. There is no indication that *H. ocellum* will become serious on sugar-cane and control on elephant grass may result by planting resistant strains.

Rayner (R. W.). **Notes on the larger fungi of Trinidad.**—*Mem. imp. Coll. trop. Agric. Trinidad* 6, 11 pp., 1941.

This is a critically annotated list of some common larger fungi of Trinidad, including several new records for the island.

Hiratsuka (N.). **Materials for a rust-flora of Riukiu Islands. II.**—*Bot. Mag., Tokyo,* liv, 646, pp. 373–377, 1 fig., 1941.

The present instalment of the writer's annotated list of rusts of the Riu-kiu Islands [*R.A.M.*, xx, p. 278] comprises 21 species, including one new to science [with a Latin diagnosis].

Hiratsuka (N.). **Uredinales collected in Korea. IV.**—*Bot. Mag., Tokyo,* liv, 647, pp. 427–432, 1941.

The present instalment of the author's annotated list of Korean rusts (part III of which appeared in *Trans. Tottori Soc. agric. Sci.*, vi, pp. 185–190, 1939) comprises 36 species, including *Pucciniastrum pyrolae* on *Pyrola renifolia*, *Melampsora larici-capraearum* [*R.A.M.*, xiv, p. 464] on *Salix hallaisanensis* var. *orbicularis*, *M. magnusiana* [ibid., xv, p. 618] on poplar (*Populus davidiana*), *Chrysomyxa komarovii* Tranzsch. on *Rhododendron mucronulatum* var. *ciliatum*, *Puccinia fagopyri* on buckwheat [ibid., xii, p. 248], *P. gypsophilae* Liou & Wang, 1935 on *Gypsophila pacifica*, and *P. helianthi* on sunflower; of these, *Pucciniastrum pyrolae*, *M. larici-capraearum*, *M. magnusiana*, and *Puccinia helianthi* are new to Korea, and *P. gypsophilae* to Japan. Included among the seven additional host records appended to the list is the broad bean (for *Uromyces fabae*).

Mayor (E.). **Étude biologique de Puccinia allii-phalaridis Klebahn.** [A biological study of *Puccinia allii-phalaridis* Klebahn.]—*Ber. schweiz. bot. Ges.*, li, pp. 313–320, 1941.

In inoculation experiments from 1937 to 1940 with teleutospores of *Puccinia allii-phalaridis* collected on *Phalaris arundinacea* on the shores of the Lake of Neuchâtel, Vaud, Switzerland, pycnidia or aecidia, or both, developed on 16 species of *Allium*, including onion, leek, garlic, *A. ascalonicum*, *A. fistulosum*, *A. schoenoprasum*, *A. scorodoprasum*, *A. ursinum*, and *A. vineale*, of which *A. ursinum* is the preferred host both in nature and in greenhouse tests. Other Liliaceae more or less

susceptible to infection include lily of the valley. With inoculum from *A. ursinum*, *Phalaris arundinacea* and *P. canariensis* were inoculated with positive results, infection on the latter, however, being very sparse.

In further experiments with teleutospores of *Melampsora allii-fragilis* and *M. allii-salicis albae* [*M. salicis albae*: *R.A.M.*. xvi, p. 277] on 26 species of *Allium*, successful infection was obtained, *inter alia*, on *A. vineale*, garlic, leek, *A. ampeloprasum*, *A. schoenoprasum*, onion, *A. fistulosum*, *A. oleraceum*, and *A. ursinum*, whereas *A. scorodoprasum* and *A. ascalonicum* remained immune from infection by the two rusts.

STEVENS (F. L.) & RYAN (MARY H.). **The Microthyriaceae.**—*Illinois biol. Monogr.*, xvii, 2, 138 pp., 1939. [Received July, 1941.] $1.50.

This monograph gives a brief review of all the species which were described apparently up to the year 1934. It opens with a key to the genera, of which 59 are accepted as valid. Each genus is briefly characterized and its most important literature cited. The terse account of each species includes the place of publication, the host range, and the measurements usually of the ascomata, and always of the asci and ascospores. The work is completed with a bibliography of 96 titles, a list of excluded species, a host index, and an index of specific names. It will no doubt prove indispensable to all students of the Microthyriaceae.

BITANCOURT (A. A.) & JENKINS (ANNA E.). **Novas especies de 'Elsinoe' e 'Sphaceloma' sobre hospedes de importancia economica.** [New species of *Elsinoe* and *Sphaceloma* on hosts of economic importance.]—*Arq. Inst. biol., S. Paulo*, xi, 9, pp. 45–58, 15 pl. (1 col.), 1940. [English summary.]

Of the three new species of *Sphaceloma* and four of *Elsinoe* collected in Brazil between 1934 and 1939 and herein technically described [with Latin diagnoses], mention may be made of *S. arachidis*, producing on groundnut leaves small, circular or irregular, scattered, sometimes confluent lesions, with sunken centres and raised margins, tilleul buff (Ridgway) to white with a narrow Natal brown margin on the upper surface, pinkish-cinnamon to clay-coloured, sometimes encircled by a sayal brown margin on the lower; on the petioles and stems the spots are more numerous and larger, oval, prominent, averaging 3 mm. in diameter, at times coalescing over more or less extensive areas and causing distortion of the affected organs. The conidiophores of the fungus are densely aggregated, piriform, yellow, 8 to 12 by 3 to 5 $\mu$, and the conidia elongated to cylindrical, tapering at both ends, continuous or uniseptate, catenulate, 12 to 30 by 3 to 4 $\mu$; numerous globose microconidia, 1 $\mu$ in diameter, are also scattered over the entire surface of the pulvinate acervuli, measuring 50 to 250 by 45 $\mu$.

On potato dextrose agar at room temperature *S. arachidis* develops slowly, forming compact, pulverulent, light vinaceous-fawn colonies with darker to black patches. Growth on beef and maize meal agar was similar. In comparative tests at 32° C. *E. phaseoli* from *Phaseolus lunatus* [*R.A.M.*, xiii, p. 345 *et passim*] were both found to be capable of growth. The inoculation of groundnuts with a culture of *S. arachidis* resulted in profuse infection.

STANLEY (W. M.) & ANDERSON (T. F.). **A study of purified viruses with the electron microscope.**—*J. biol. Chem.*, cxxxix, 1, pp. 325–338, 4 pl., 1 graph, 1941.

Preparations of five viruses purified by differential centrifugation were studied under the electron microscope [*R.A.M.*, xx, p. 375]. The micrographs of the strain of tobacco mosaic used in these researches showed a predominating unit measuring 280 by 15 m$\mu$, presumably representing single particles of the virus, together with end-to-end and side-to-side aggregates of the same unit and a few shorter rods. The fact that the dimensions of this unit were of the same order of magnitude as those previously calculated by indirect methods based on physico-chemical data indicates that the latter procedures serve a useful purpose and are essentially reliable when correctly applied, even for asymmetrical particles. Since the particle length of the virus under observation significantly exceeded the figures of two strains studied by other workers [ibid., xx, p. 236], different strains of a virus may presumably vary in particle length.

The electron micrographs of cucumber viruses 3 and 4 [ibid., xix, pp. 555, 668] were very similar, showing extensive end-to-end aggregation, and revealed close similarities in respect of size (length of 300 m$\mu$) and shape between these two viruses and tobacco mosaic. In this connexion it may be mentioned that C. A. Knight (unpublished data) has found that cucumber virus 3 and tobacco mosaic, despite the wide differences in their host range, have very similar physical, chemical, and immunological properties [ibid., xvii, p. 564].

The particles of the tomato bushy stunt [ibid., xv, p. 672; xix, p. 353] and tobacco necrosis [ibid., xix, p. 732] viruses were both spherical and measured 26 and 20 m$\mu$ in diameter, respectively.

ANDERSON (T. F.) & STANLEY (W. M.). **A study by means of the electron microscope of the reaction between Tobacco mosaic virus and its antiserum.**—*J. biol. Chem.*, cxxxix, 1, pp. 339–344, 1 pl., 1 diag., 1941.

Micrographs of a mixture of tobacco mosaic virus and normal rabbit serum [*R.A.M.*, xvi, p. 210] showed virus particles of normal size [see preceding abstract] and indicated little or no adsorption of particles from the serum on to the virus molecules. Similar results were obtained with mixtures of tobacco mosaic virus with antisera to the tomato bushy stunt, potato latent mosaic [virus X], and tobacco ring spot viruses. A mixture of tobacco mosaic virus and the antiserum of the same virus from rabbits, dried on a collodion film an hour after mixing and examined under the electron microscope, shows particles of increased width (300 by 60 m$\mu$), with fuzzy profiles, features believed to indicate that the ends of asymmetrically shaped molecules from the serum react specifically with those from the antigen. No reaction between anti-tobacco mosaic virus serum and the bushy stunt virus was demonstrable. These results are considered to establish the utility of the electron microscope, and of a large and distinctively shaped antigen, such as the tobacco mosaic virus, in the study of antigen-antibody reactions.

Silberschmidt (K.) & Kramer (M.). **Brazilian Bean varieties as plant indicators for the Tobacco-mosaic virus.**—*Phytopathology*, xxxi, 5, pp. 430–439, 3 figs., 1941.

Most of the 74 bean (*Phaseolus vulgaris*) varieties used in the writers' comparative studies at the São Paulo (Brazil) Biological Institute on the response of these plants to inoculation by rubbing with the tobacco mosaic virus [*R.A.M.*, xviii, p. 632] at dilutions of 1 in 5, 1 in 10, 1 in 100, or 1 in 1,000 were obtained from the Campinas Agronomic Institute, while a few were purchased on the São Paulo market. The complexity of the reactions displayed necessitated the division of the beans into four groups (one more than Price included in his classification [ibid., ix, p. 810]), viz., strong, medium, weak, and negative. Characteristic of the strong category are well-defined, necrotic lesions consisting of a brown ring, about 1 mm. in diameter, with a paler nucleus; the medium-reaction varieties exhibit necrotic lesions resembling small, compact, dark plates distinct enough for easy counting; the minute spots of the weak group, on the other hand, are many or few and so difficult to number that varieties giving this response are unsuitable for inclusion in statistical studies; a negative reaction is constituted by the absence of any local necrotic lesions within a 20-day period. Among the eight varieties of the strong group may be mentioned Thousand-to-one, Scotia, and Robust; of the medium (12), Jaboticabal C, Campineiro, and Idesso; and of the negative (17), Staley's Brown Beauty, Canadian Wonder, Long Fellow, Great Northern, Stringless Greenpod, Baalbek, and three strains of Manteiga.

**Blue mould of Tobacco.**—*Rep. Fla agric. Exp. Sta., 1938–40*, pp. 17–18, 1941.

In 1938 and 1939 the Florida State Plant Board organized demonstrations for tobacco-growers in the control of blue mould [*Peronospora tabacina*: *R.A.M.*, xx, p. 384], which was effectively combated, even in cases of 100 per cent. infection, by two applications at 24-hour-intervals of 3 to 4 lb. para-dichlorbenzene per 100 sq. yds of plant bed, leaving the beds continuously covered with a heavy cloth of unbleached sheeting with 54 by 56 threads per sq. in., or one treatment with 5 to 6 lb. The treated plants sustained no injury except in a few instances where the ground was wet, the sun shone during the day, and the cloth was in unduly close proximity to the seedlings; slight injury was also observed when the crystals were unevenly distributed. Benzol was equally effective against *P. tabacina*, but the costs of application were heavier. In 1939 the disease was first observed on 9th February, and on 6th March it was present in nearly every bed examined, killing all the plants in the untreated sections.

Koch (L. W.). **Control of the blue mould disease of Tobacco.**—*Publ. Canad. Dep. Agric.* 716 (*Circ.* 171), 4 pp., 2 figs., 1941.

Tobacco blue mould (*Peronospora tabacina*) [see preceding abstract] has been observed for the past three years in the south-western tobacco belt of Ontario.

As, locally, the fungus often overwinters in the soil of affected seed-beds and also makes its first appearance in the seed-beds, affected beds

must be thoroughly cleaned up; the soil must be steamed, and the seed-bed parts (including paths and walls) in contact with the plants and soil must be disinfected with a 10 per cent. solution of formalin. The beds should be situated in a sunny position, and should be adequately ventilated. When infection occurs in seed-beds with cotton covers, the covers should be removed as early as possible each morning to increase evaporation of excess water. Spread from cotton-covered beds to neighbouring glass-covered beds may be prevented by keeping the latter at a high temperature by means of artificial heating; night temperatures in such beds should be kept between 70° and 90° F.

Directions are also given for gas treatment with benzol and paradichlorbenzene. Before the disease appears spraying should be effected with red copper oxide (85 to 90 per cent. copper) ½ lb., cotton-seed oil ½ lb., and emulsifier (1 qt. lethane spreader), per 40 gals. water. Applications should be made twice a week unless the plants are very small, using 3 gals. per 100 sq. yds. at first, and increasing to 8 gals. In tests at Harrow, some leaf injury was caused by this spray.

Clinch (Phyllis E. M.). **Virus diseases of Tomato.**—*J. Dep. Agric. Éire*, xxxviii, 1, pp. 24–47, 7 figs., 1941.

After describing the chief virus diseases affecting tomatoes, the author states that the commonest in Eire is single-virus streak [*R.A.M.*, xx, p. 384], which generally manifests itself in the mosaic form. Aucuba mosaic has been observed in outbreaks at two centres, enation mosaic has been recorded once only (1940), double-virus streak (potato virus X+single streak) occasionally occurs, and spotted wilt occurs almost every year. True common tomato mosaic has not yet been observed, but a speckle or 'scorch' of the lower leaves of tomato plants, the tops of which showed a conspicuous mosaic, was found by immunity tests to be due to a strain of this virus. The name 'speckling mosaic' is suggested for the disease. The lower fruit trusses of affected plants showed irregularly shaped, colourless or light brown, usually sunken areas. Outbreaks of single-virus streak are attributed to the use of diseased seed and of spotted wilt to infection from arum lilies, chrysanthemums, and dahlias transmitted by *Thrips tabaci*. Manurial tests with pot plants demonstrated that conditions conducive to soft growth were also favourable to the necrosis symptoms of single-virus streak, and increased the intensity of the mosaic symptoms. The suggestion is made that the necrosis occurs either as a primary symptom of single-virus streak or not at all. The maintenance of a well-balanced or rather 'hard' type of growth reduces the intensity of mosaic and streak symptoms in infected crops.

Selman (I. W.). **Spotted wilt disease of Tomatoes.**—*Gdnrs' Chron.*, Ser. 3, cix, 2843, pp. 241–242, 1941.

An alarming increase in spotted wilt of tomato [*R.A.M.*, xx, p. 282] has been observed in English nurseries, particularly in those which were previously growing ornamental flowering plants. Severe attacks have occurred in the Worthing district and in East Anglia, while nearly 1,000 seedlings have been affected in one small nursery in Dorset. For the control of this disease it is essential to isolate tomato seedlings from

ornamental plants, which for practical purposes may all be regarded as possible hosts. Affected plants, both tomato and ornamentals, should be immediately removed and burnt and the thrips vector controlled by means of sprays, dusts, and fumigants.

THOMAS (W.) & MACK (W. B.). **Susceptibility to disease in relation to plant nutrition.**—*Science*, N.S., xciii, 2408, pp. 188–189, 1 fig., 1941.

In an experiment at the Pennsylvania State College, tomatoes grown on a plot fertilized with nitrogen only (as commercial sodium nitrate) exhibited symptoms of streak disease about 80 days after being transplanted into the beds, whereas those grown on plots fertilized with rotted manure and complete fertilizer remained healthy. The course of nutrition in the diseased and the healthy plants was examined by the method of foliar diagnosis, and it was found that the sum of the percentages of nitrogen, phosphoric acid, and potash, which represents the intensity of nutrition, was 7·90 for the healthy plants, 4·86 for plants showing no visible symptoms of disease at the time of sampling, 4·43 for those showing slight, and 5·65 for those showing severe symptoms. Infection by the virus was associated with a less intense type of nutrition, characterized by higher values for nitrogen and much lower values for potash in the composition of the NPK-units of the susceptible compared with resistant plants.

METCALFE (G.). **The watermark disease of Willows. II. Pathological changes in the wood.**—*New Phytol.*, xl, 2, pp. 97–107, 1 pl., 4 figs., 1941.

Continuing his study of the watermark disease of the cricket-bat willow [*Salix coerulea*: *R.A.M.*, xx, p. 94], the author states that the presence of the associated bacterial flora [*Bacterium salicis* and other organisms: loc. cit.] induces two important histological changes in the wood: 'oily degeneration' of the protoplasm of certain ray vessels, resulting in the death of the cells, and the appearance of tyloses in the vessels.

In the affected ray cells the cytoplasm masses together round the sharply defined vacuoles and assumes a moderately homogeneous texture, often staining deeply with osmic acid. In other cells, large oil globules form in the cytoplasm, passing into the vacuoles, where they accumulate. This form of degeneration often occurs in upright ray cells. Still other cells lose most of their protoplasmic contents, and the cytoplasm remaining forms sharply defined masses, often in association with a large clear globule, apart from which oil globules are generally few or absent. This kind of degeneration is very common in the procumbent ray cells. In some cells, most of the protoplasmic contents disappear, but the degeneration resembles the 'normal' process in healthy wood; the contents of these cells never give the osmic acid stain.

In all cases, the cell contents become coloured with a brown-staining substance, discoloration taking place at any stage. The coloured cells are probably dead and the brown compound appears to protect the cell contents by rendering them insoluble in ether and chloroform, while it frequently interferes with the osmic acid stain.

In a diseased annual ring tylosis formation occurs locally in the region where the vessels are infected. During spring, when the wood is first invaded by bacteria, tyloses appear sporadically; many more appear in winter. Very few appear when the wood is invaded by secondary organisms, possibly because most of the ray cells are already degenerated. The tyloses form into vessels whether the vessels contain bacteria or not. The bacteria are compressed into compact masses between the tyloses, and later in the season these masses show a brown stain and are non-viable.

The protoplasmic contents of the tyloses undergo the same type of oily degeneration as do the contents of any ray cell in an affected region, and also show the brown stain. As the thin tylosis wall is often closely adpressed to the vessel wall, vessels containing such tyloses appear, when examined in transverse sections, to have granular or gum-like brown contents. Degeneration of the contents may take place before the tylosis is large enough to occlude the vessel, and such tyloses do not further enlarge.

The evidence [which is discussed] would appear to indicate that the degeneration results from disturbed physiology brought about by the presence of bacteria. The brown stain is probably an oxidation product of catechol tannins or their breakdown products. Initiation of tylosis formation is associated with the presence of gas in the vessels.

Gray (E.). **The Willow wood wasp and watermark disease of Willows.**—*Vet. J.*, xcvi, 9, pp. 370–373, 1940.

During the summer of 1938 a series of investigations was carried out in Essex to determine the possibilities of implication of the willow wood wasp [*Xiphydria prolongata* Geoffr.] in the transmission of the watermark disease of willows caused by *Bacterium salicis* [see preceding abstract]. The organism isolated from the ova, larva, pupa, and imago of the insects in a manner indicative of direct hereditary transmission was stated by W. J. Dowson to be not the watermark pathogen itself, but a closely allied form associated with it in the diseased wood. Since the organism in question is transmissible from diseased to healthy wood, the destruction by burning of felled infected trees is recommended.

**Annual Report, Department of Agriculture, Northern Rhodesia, for the year 1940.**—8 pp., 1941.

On p. 5 of this report it is stated that by the Importation of Plants (Dahlia) Regulations, 1940, the importation of dahlia plants and tubers from the Union of South Africa into Northern Rhodesia is forbidden, to obviate the introduction of kromnek disease [spotted wilt] of tomatoes and tobacco [*R.A.M.*, xix, p. 576; xx, p. 282].

**Rules and regulations made by the State Plant Board pursuant to the Florida Plant Act of 1927 and the bee disease law of 1927.**—*Mon. Bull. Fla Pl. Bd*, N.S., i, 2, pp. 10–47, 1940.

A summary is given of the legislative measures operative against citrus canker (*Bacterium* [*Xanthomonas*] *citri*) and other diseases and pests in Florida [*R.A.M.*, vii, p. 287; xv, p. 336].

IMPERIAL MYCOLOGICAL INSTITUTE

# REVIEW
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LIHNELL (D.). **Schizophyllum commune som trädparasit i vårt land.** [*Schizophyllum commune* as a tree parasite in our country.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh., 1941*, 1, pp. 11–12, 1941.

Attention is drawn to the occurrence of *Schizophyllum commune* as a parasite of living trees in Sweden; it was previously little known in the country and then only as a saprophyte on winter-killed wood. At the end of 1940, however, O. Andersson, of the Lund Botanical Museum, made two collections of the fungus, one on living apple and plum trees and the other on ash.

PIRONE (P. P.). **Chlorosis of Pin Oaks and its control.**—*Shade Tree, N.J.*, xiii, 12, pp. 1–4, 1940. [Abs. in *Chem. Abstr.*, xxxv, 9, p. 2930, 1941.]

Pin oaks [*Quercus palustris*] growing in an area that had been filled in with ashes and other waste developed acute chlorosis and stunting. A marked improvement in the state of the trees was obtained by the insertion of 1 to 4 capsules (according to the diameter of the tree) containing 5 gm. ferric phosphate into holes bored obliquely downwards to a depth of about 2 in. and equally spaced round the trunk, grafting wax being used to seal them. Leaf colour and twig growth were also ameliorated by punching holes in the soil round the root zone of the tree and introducing a 2 : 1 : 1 mixture of ferrous sulphate, sulphur, and aluminium sulphate at the rate of 3 to 5 lb. per tree.

ISRAILSKI (V. P.) & ARTEMIEVA (Mme Z. S.). **Biological properties of the agent (Bacterium mori) of Mulberry-tree bacteriosis.**—*Микробиол.* [*Microbiol.*], viii, pp. 888–898, 1939. [Russian, with English summary. Abs. in *Chem. Abstr.*, xxxv, 11, p. 3673, 1941.]

The lytic action of the bacteriophage of *Bacterium* [*Pseudomonas*] *mori*, the agent of mulberry bacteriosis in the U.S.S.R. [*R.A.M.*, xvi, p. 785], is stated to be non-specific. The bacteriophage exerts a prophylactic effect against mulberry leaf infection by *P. mori* and falls into two groups of strains, acid and alkaline, of which only the former ferment glucose and sucrose. The serological method of diagnosis of infection [ibid., xix, p. 73] in the host gives the most accurate results.

An emulsion of a pure culture of the bacteriophage of *P. mori* or the pulp of diseased mulberry leaves, introduced into garden soil, will lose its activity in about six days.

Starygina (Mme L. P.), Goldin (M. I.), Lyagina (Mme N. M.), & Tryasunova (Mme T. I.). **Mulberry bacteriosis.**—*Микробиол.* [*Microbiol.*], ix, pp. 282–294, 1940. [Russian, with English summary. Abs. in *Chem. Abstr.*, xxxv, 11, p. 3681, 1941.]

The various strains of *Bacterium* [*Pseudomonas*] *mori* isolated from samples of mulberry leaves from the Ukraine, Crimea, and other regions of the U.S.S.R. [see preceding abstract] were found to be identical in their morphology, physiology, and agglutinative action, and to correspond with the description of the organism given by [E. F.] Smith (*Science*, N.S., xxxi, p. 792, 1910). Cultures of *P. mori* remain stable and retain their virulence at a temperature range of 0° to 30° C. for a lengthy period, which is curtailed by warmer conditions or desiccation. Infection is not seed-borne, but may overwinter in diseased foliage in the soil and spread during the next growing season.

Weiss (F.) & Baumhofer (L. G.). **Culture, diseases, and pests of the Box Tree.**—*Fmrs' Bull. U.S. Dep. Agric.* 1855, 18 pp., 9 figs., 1 map, 1940.

In this popular leaflet on the cultivation of boxwood (*Buxus sempervirens*) in the United States, it is stated that debility and dying-off of the shrub have been prevalent since the drought years of 1930 and 1931 and the exceptionally cold winters of 1934 and 1935. The symptoms include change in the colour of the foliage to yellowish- or greyish-green, weak growth and premature dropping of old leaves, death of entire branches, and the formation of sunken areas in the bark of the trunk. Primary causes of the condition are thought to be cultural or climatic (notably winter injury), but *Macrophoma candollei* [*R.A.M.*, xiii, p. 737] associated with leaf cast and *Volutella* [*Chaetodochium*] *buxi* [loc. cit.] with twig blight develop on weak or injured plant parts. The latter fungus and *Verticillium buxi* [loc. cit.] are characteristically associated with wilt or canker, which are possibly aspects of the same disease, but the significance of these agents as primary parasites is not fully established. As a measure of control, it is recommended to prune out thoroughly the affected branches as low down as the disease can be traced and to excise bark cankers completely, taking care to coat the exposed areas with shellac.

**Disease of Silver Fir in underplanting.**—*Gdnrs' Chron.*, Ser. 3, cix, 2843, p. 236, 1941.

It is reported that silver fir (*Abies alba*) trees [in Britain] have been recently attacked by a disease caused by *Trichosphaeria parasitica* [*Acanthostigma parasiticum*]. It is suggested that the disease is due to planting the trees under too intense shelter where the soil is moist. Diseased trees are very restricted in growth and young shoots wither and become bleached in appearance, while the terminal shoot generally remains unaffected. Young trees are found, however, to recover quite satisfactorily, recuperation being accelerated by opening up the wood

to admit more light and air. Any kind of silver fir is liable to attack by the fungus and hemlock (*Tsuga*) is also known to be susceptible.

HARRIS (T. H.). **The sampling of Ribes populations in blister rust control work.**—*J. For.*, xxxix, 3, pp. 316–323, 1 map, 1941.

An accurate knowledge of the number of currant and gooseberry bushes and their distribution in forest areas is a pre-requisite condition of *Ribes* eradication, and thus constitutes an important factor in the blister rust [*Cronartium ribicola*] control campaign in the sugar pine [*Pinus lambertiana*] stands of California and southern Oregon. Such information is gained by the systematic sampling, known as 'checking', of control areas by a statistical method which is described in detail. The method has yielded satisfactory results, the detailed maps depicting *Ribes* populations, forest types, and topographical features being of sufficient accuracy to form the basis for intelligent planning and effective performance of the work of eradication.

HAIG (I. T.), DAVIS (K. P.), & WEIDMAN (R. H.). **Natural regeneration in the Western White Pine type.**—*Tech. Bull. U.S. Dep. Agric.* 767, 98 pp., 12 pl., 1 graph, 9 maps, 1941.

Forest tree diseases are stated to create some of the most difficult and troublesome problems in the management of trees of the western white pine (*Pinus monticola*) type in northern Idaho and the contiguous portions of Washington, Montana, and British Columbia. Foremost among these is white pine blister rust (*Cronartium ribicola*), an account of the progress of the eradication campaign against which to date is given [see preceding abstract]. The most prevalent and familiar of the other diseases of *P. monticola* and its ecological associates are the heartwood rots, the order of importance of which was found closely to approximate to Weir and Hubert's ranking (*J. For.*, xvii, pp. 666–681, 1919), viz., *Fomes pini*, *Polyporus schweinitzii*, *F. annosus*, and *Armillaria mellea* on western white pine itself; *F. pini*, *F. officinalis*, and *P. schweinitzii* on western larch (*Larix occidentalis*); *P. schweinitzii*, *F. pini*, *A. mellea*, and *P. sulphureus* on Douglas fir (*Pseudotsuga taxifolia*); *Echinodontium tinctorium* [*R.A.M.*, xiv, p. 205] and *F. annosus* on grand fir (*Abies grandis*) and western hemlock (*Tsuga heterophylla*); and *Poria weirii* [ibid., xi, pp. 140, 615] and *F. pini* on western red cedar (*Thuja plicata*). A study by I. V. Anderson of the incidence of cull due to rotting (*Appl. For. Note, nrth Rocky Mtn For. Range Exp. Sta.*, 63, 1934) in *Pinus monticola* of eight age groups from 81 to 301 years and onwards showed a steady rise from 3 per cent. in the first to 24 per cent. in the last, the weighted average for the series being 15 per cent. Weir and Hubert (*Bull. U.S. Dep. Agric.* 799, 24 pp., 1919) found red ring rot (*F. pini*) in nearly all trees over 200 years old in the Coeur d'Alene and Kaniksu forests, the fruiting bodies frequently appearing only on trees 120 years old or more. From the silvicultural standpoint the most important conclusion to be drawn from these studies is that rot in standing *P. monticola* can be largely avoided by cutting at or below 120 years. In *Tsuga heterophylla* infection by *E. tinctorium* may develop at a comparatively early stage in the life of the tree, Hubert (*Rep. U.S. Dep. Agric.* [illegible]

unpublished) detected 46, 94, and 100 per cent. in the 41 to 80, 121 to 160, and over 200 age groups, respectively. *A. grandis* suffers nearly as heavily as *T. heterophylla* from rot due to this fungus. *Thuja plicata*, *L. occidentalis*, and Douglas fir are relatively free from decay except at an advanced age.

McKenzie (H. L.). **Injury by Sugar Pine Matsucoccus scale resembles that of blister rust.**—*J. For.*, xxxix, 5, pp. 487–488, 1941.

Attention is drawn to the strong resemblance between the injuries inflicted on sugar pines (*Pinus lambertiana*) in California, Oregon, Montana, and Wyoming by the scale insect *Matsucoccus paucicicatrices* and incipient blister rust [*Cronartium ribicola*] cankers, introducing a serious complication into the campaign for the eradication of the latter. W. W. Wagener, of the Division of Forest Pathology, Bureau of Plant Industry, points out that microscopic examination of the bark tissues is necessary for the reliable differentiation of the two forms of injury.

Offord (H. R.). **The function of tannin in host-parasite relationships, with special reference to Ribes and Cronartium ribicola.**—[*Bull.*] *U.S. Bur. Ent.* E 518, 27 pp., 1940. [Abs. in *Exp. Sta. Rec.*, lxxxiv, 5, pp. 638–639, 1941.]

In connexion with an intensive study on the chemical properties, function in plants, and influence of tannin on host-parasite relationships, with special reference to *Ribes* and white pine blister rust (*Cronartium ribicola*), the seasonal tannin content was determined for the leaves, current-season and old stems, and roots of *R. petiolare*, *R. inerme*, *R. viscosissimum*, *R. lacustre*, *R. nevadense*, and *R. roezli* [*R.A.M.*, xix, p. 628]. In general, there was an increase up to the middle of the growing season, the maximum tannin content occurring in the leaves and the minimum in the old stems. The quantity of tannin could not in itself be used as the sole index of the reaction of the *R.* spp. to *C. ribicola*. An analysis of the decomposition products of the tannin mass of *R. petiolare* and *R. inerme* (highly and moderately susceptible, respectively) revealed in the latter a higher content of catechol tannins, which probably exerted a stronger specifically toxic action on the rust than the tannins of the former species, which were predominantly of the gallotannin type. Differences were further detected in the ratio of alcohol to water-soluble tannins between *R. petiolare* and the less susceptible *R. inerme*, *R. lacustre*, and *R. viscosissimum.* In the leaves of *R. petiolare*, *R. inerme*, and *R. lacustre* the tannins were concentrated in the epidermal layers and round the vascular bundles. A bibliography of 59 titles is appended.

Bagchee (K.). **Contributions to our knowledge of the morphology, cytology and biology of Indian coniferous rusts. Part I. Cronartium himalayense Bagchee and Peridermium orientale Cooke on Pinus longifolia Roxb.**—*Indian For. Rec.*, N.S., Bot., i, 7, pp. 247–266, 1941.

*Pinus longifolia* inoculated at the Forest Research Institute, Dehra Dun, with teleutospores of *Cronartium himalayense* [*R.A.M.*, ix, p. 146] developed the *Peridermium* stage. The maximum production of

aecidiospores, with which the death of the trees mostly coincides, takes place during the third and fourth springs following infection of the twigs through mature needles, and the fourth and fifth springs following infection of juvenile needles on thicker stems.

*P. orientale* Cke on *Pinus longifolia* is shown to be a stage of *Coleosporium campanulae* on *Campanula colorata* [ibid., xvii, p. 278], the form of the rust on *C. canescens* being a distinct physiologic race incapable of infecting *P. longifolia*.

Three appendices furnish a synopsis of the coniferous rusts of India and their hosts, *Peridermium indicum* being listed as a stage of *Cronartium ribicola* on *Pinus excelsa* [ibid., xvi, p. 146].

Scheffer (T. C.). **Drying rates of blue-stained and bright lumber.**—*Sth. Lumberm.*, clxii, 2039, pp. 46–48, 1941.

From controlled drying experiments under uniform conditions, using short sections of 1 in. by 6 in. unseasoned lumber of loblolly pine [*Pinus taeda*] and sweet gum [*Liquidambar styraciflua*], it was concluded that blue stain does not retard drying but in various degrees promotes it. Equilibrium moisture contents of stained and bright wood were practically the same. Occasional reports that shipments of lumber with a substantial amount of stain tend to be heavier than similar lots containing bright material are believed to have been based on observations of stock that had not been comparably seasoned.

Williams (P. H.). **Important diseases of glasshouse plants.**—*Fruitgrower*, xci, 2372, pp. 465–467, 1941.

Some useful information is presented in a semi-popular form on the principal diseases of the three chief food crops cultivated in glasshouses, viz., tomatoes, lettuces, and cucumbers, and their control by sanitary measures and fungicidal treatments. The tomato diseases discussed are damping-off and foot rot (*Phytophthora cryptogea* and *P. parasitica*), sleepy disease (*Verticillium albo-atrum*), root rot (largely due to the unfavourable effects of cold, heavy soils and preventable to a great extent by the insertion of straw in walls, allowing water and air to penetrate to the lower soil layers); leaf mould (*Cladosporium fulvum*), a promising variety resistant to which, named Vetomold, has recently been imported from Canada (further information obtainable from the Director of the Cheshunt Research Station); late blight (*P. infestans*), against which spraying with bouisol is recommended; grey mould of the stems and watery rot and water spot of the fruits (*Botrytis cinerea*); buck-eye fruit rot (*P. parasitica*); blossom-end rot; the ripening anomalies known as 'blotchy ripening' and 'greenback' [*R.A.M.*, xv, p. 690]; and the viruses of mosaic, streak, and spotted wilt, the last-named most troublesome in mixed nurseries.

*B. cinerea* is the chief parasite of lettuce, to which downy mildew (*Bremia lactucae*) is also sometimes very destructive. Raising the temperature for one night to 60° F. after watering has been found beneficial at Cheshunt against both these fungi.

Cucumbers are liable to infection by *V. albo-atrum*, root rots due to *Fusarium* spp., mildew (*Erysiphe cichoracearum*), and virus diseases, an important remedy against which consists in the exclusive use of

clean seed. At Cheshunt this precaution has eliminated mosaic from the main experimental houses for some years, notwithstanding the proximity of large numbers of diseased plants.

Croxall (H. E.) & Ogilvie (L.). **The effect of seed dressings containing growth-promoting substances on Lettuce, Tomato, Sugar Beet, and Dwarf Bean.**—*Rep. agric. hort. Res. Sta. Bristol, 1940*, pp. 29–34, [1941].

Experiments are described in which the seeds of lettuces, tomatoes, sugar beets, and dwarf beans [*Phaseolus vulgaris*] were treated with dressings consisting of α-naphthalene-acetic acid or a preparation of mixed naphthylidene-acetic acids [*R.A.M.*, xx, p. 106] incorporated, at concentrations ranging from 1 to 100,000 p.p.m. by weight of the hormone, in talc, cuprous oxide, and zinc oxide. In one test, lettuce seeds treated with cuprous oxide without hormone gave lettuces significantly less in weight than those from untreated seeds, while the lettuces grown from seeds treated with cuprous oxide plus α-naphthalene-acetic acid did not show this reduction. Apart from this one result, under the experimental conditions, the hormones exercised no influence on crop weight.

Wallace (T.). **A note on manganese deficiency in agricultural and horticultural crops.**—*Rep. agric. hort. Res. Sta. Bristol, 1940*, pp. 19–23, [1941].

The more notable cases of manganese deficiency of crops occurring in England have been found in Romney Marsh, the Fens (including parts of Cambridgeshire and Lincolnshire), the West Midlands, including Warwickshire, Staffordshire, and Shropshire, and in Lancashire, Derbyshire, Somerset, and Bristol. Investigations have demonstrated that manganese as an element is not deficient in the soils concerned in any absolute sense, but that it is unavailable to plants because of conditions in the soils which may have developed naturally or may have been brought about by farming practices. Two factors common to soils associated with manganese deficiency are high organic matter and high lime ($P_H$ over 6·5).

In the Bristol district the most susceptible horticultural crop appears to be Globe beetroot, the long varieties being much less susceptible. Spinach and spinach beet are highly susceptible. Other vegetables affected are parsnip, parsley, Cos lettuce, onion, dwarf and runner beans [*Phaseolus vulgaris* and *P. coccineus*], and vegetable marrow. Among fruits, apples and raspberries have shown interveinal chlorosis of the leaves, the leaves of fruited raspberry canes being more severely affected than the young new seasonal growths. In all crops much natural recovery may occur among plants surviving the early stages of growth.

In the Bristol area failures of agricultural crops have been wholly confined to areas of newly ploughed-out old grassland. All but one of the failures in horticultural crops were brought about by the use of heavy dressings of poor-quality town stable manure and excessive liming.

For purposes of control highly susceptible crops should not be grown.

Good-quality farmyard manure will eradicate the trouble during the year of application only. Application of finely ground sulphur (5 cwt. to 1 ton per acre) has given excellent results. Manganese sulphate has also given a high level of control, used as a fertilizer at sowing time at the rate of 1 cwt. per acre, or applied as a spray or dust to the foliage of the young plants at rates ranging from 20 to 60 lb. per acre. In one instance, the condition was controlled on sugar beet after two sprayings each at the rate of 2·5 lb. of manganese sulphate per acre. The residual effects of this material for later crops appear, however, to be negligible, and a fresh application becomes necessary for each crop.

WALLACE (T.). **Magnesium deficiency of fruit and vegetable crops.**—*Rep. agric. hort. Res. Sta. Bristol, 1940*, pp. 24–28, [1941].

A marked case of magnesium deficiency of vegetables was recorded in 1940 at Long Ashton [cf. *R.A.M.*, xx, p. 68] on land that had previously grown excellent crops. Cauliflowers, broccoli, Brussels sprouts, and early savoys grew well at first, but after 7·92 in. of rain in July, the leaves of the entire crop of cauliflowers developed a yellow and white mottle and diffused red and purple tints [ibid., xix, p. 687]. The broccoli was also affected, though less conspicuously, and the Brussels sprouts showed some discoloration, with well-marked patches of poor growth. Only a few leaves among the savoys showed any mottling. Further investigations are in progress.

OLSSON (P. A.). **Klumprotsjuka (Plasmodiophora brassicae Wor.) på Rovor och Kålrötter samt åtgärder mot densamma, speciellt ur växtförädlingssynpunkt. II. Fortsatta undersökningar samt försök med resistensförädling.** [Club root disease (*Plasmodiophora brassicae* Wor.) on Turnips and Swedes, together with precautions against the same, especially from a plant-breeding standpoint. II. Continued investigations and experiments in breeding for resistance.]—*Sverig. Utsädesfören. Tidskr.*, l, 6, pp. 287–360, 15 figs., 1940. [English summary.]

From this exhaustive, fully tabulated survey of further experiments from 1937 to 1939, inclusive, in the development of turnip and swede varieties resistant to club root (*Plasmodiophora brassicae*) on the clay and peat soils of an estate reserved for this purpose by the Swedish Seed Association, it is clear that the six selected lines of the Majrova amply fulfilled the expectations raised by the results of previous tests [*R.A.M.*, xviii, p. 776]. Particularly satisfactory were the performances of Nos. 8026 and 8056 of strain JO13, the numbers of healthy plants of the former on clay and peat in 1939 being 71·4 and 60·9 per cent., respectively, and of the latter 95·6 and 48·8 per cent., respectively, compared with 1·5 and 3·9 and 1·3 and 6·1 per cent., respectively, for the 'standard' variety (Weibull's Original Immuna) in the two soil types. Two of the six selected lines of the cross Bortfelder × Mainaepe were also of outstanding promise, viz., the $F_2$ No. 8044, with 62·5 and 60·9 per cent. healthy plants in the clay and peat soils, respectively, compared with 0·7 and 3·5 per cent., respectively, for Immuna, and the $F_3$ No. 8060, with 54·4 and 35·6 per cent. healthy plants in clay

and peat, respectively, as against 1·3 and 2·9 per cent., respectively, for Immuna. The $F_2$ of Majrova JO13 was submitted for testing in 1939 to the West Gothland branch of the Association, where it also showed a notable degree of resistance to club root, besides outyielding the commercial Svälof's Majrova JO13 by 7·8 per cent. The index of specific resistance, defined as the ratio of per cent. healthy + per cent. slightly diseased plants of a selected strain to the per cent. healthy + per cent. slightly diseased plants of the standard variety, of the Majrova JO13 selection, is calculated to have increased from 1·1 in 1936 to 1·7 in 1937 and 5·4 in 1939.

Greis (H.). **Ein Wurzelbrand an der Zuckerrübe, verursacht durch Alternaria tenuis.** [A black leg of Sugar Beet caused by *Alternaria tenuis*.]—*Phytopath. Z.*, xiii, 2, pp. 196–206, 5 figs., 2 graphs, 1940.

In examining the germinability of a sample of sugar beet seeds [? at Kleinwanzleben, Germany], all seedlings grown from these seeds were found to perish from black leg. Isolations yielded *Pythium*, *Phoma*, *Macrosporium* [*R.A.M.*, xix, p. 319], as well as *Alternaria tenuis* [loc. cit.], a species hitherto only known as a saprophyte on beet. In artificial infection experiments it was found that *A. tenuis* is spread through the seed, which it attacks saprophytically, later developing as a facultative parasite on seedlings, and killing large numbers. Excessive humidity at the time of the swelling of the seed is essential for successful infection to take place. On insufficiently dried seed the fungus spreads rapidly, and the speedy and thorough drying of seed is therefore recommended. In dry weather the incidence of the fungus is much restricted. For the control of the disease seed treatment is advised, especially as it is equally necessary against the other organisms involved in black leg. Germisan gave particularly good results when applied as a dust at the rate of 350 to 400 gm. per 50 kg. of seed. The germisan short liquid treatment was equally effective, but required subsequent drying of the material; ceresan 1875a and UT685 gave fair control.

Zazhurilho (V. K.). **Pea varieties with pods resistant to Ascochyta pisi Lib.**—*C. R. Acad. Sci. U.R.S.S.*, N.S., xxix, 4, pp. 351–352, 1940.

All the pea varieties, numbering about 100, tested for their reaction (200 plants and 400 pods of each variety) to *Ascochyta pisi* at the Kamennostepnaya Plant Breeding Station, Voronezh, U.S.S.R. [*R.A.M.*, xvii, p. 427] in 1935, proved to be highly susceptible in respect of their vegetative parts, but there were noticeable differences in the effect of the pathogen on the pods. For instance, of the 20 varieties of which the reactions are shown in tabular form, six contracted under 5 per cent. pod infection, viz., Manshold, Solo, Folger Heine, Waxy O19, Concordia, and Mench, with 4·0, 4·0, 3·5, 2·7, 2·5, and 2·8 per cent., respectively, though the incidence of spotting on the vegetative parts in the same varieties amounted to 89·5, 100, 98·5, 91·5, 98·5, and 100 per cent., respectively. Not only was the actual percentage of pod infection in these varieties low, but the character of the spotting was very mild, a matter of special importance in procuring sound seed.

Hickman (C. J.). **The prevalence and significance of Pea seed infection by Ascochyta sp.**—*Rep. agric. hort. Res. Sta. Bristol, 1940*, pp. 50–54, [1941].

Examination of 29 sample lots of English-grown pea seed in 1940 revealed that 26 were infected by *Ascochyta pisi*, 8 of them to the extent of 20 per cent. or more, while of 43 foreign-grown samples only 17 were infected, of which none showed over 20 per cent. infection and only very few over 10 per cent. In a field trial in which infected Foremost seed was divided into lots containing 5, 10, 20, 30, 40, and 50 per cent. infected seeds and planted, the mean emergence was 345, 324, 294, 294, 230, and 222, respectively, and the mean crop weights 17·3, 17·6, 15·6, 15·1, 15·7, and 13·3 lb., respectively. Statistical analysis of these results indicated that unless a stock carries over 20 per cent. infection the stand is not likely to be much reduced. It also showed that if the disease does not develop beyond killing off the seed and seedlings below soil-level, seed showing 50 per cent. infection may not cause a significantly greater loss of crop than seed with only 5 per cent. infection. This raises the question of the amount of seed necessary to secure an optimum crop.

Parris (G. K.). **Comparison of rates of apparent photosynthesis and respiration of diseased and healthy Bean leaflets.**—*J. agric. Res.*, lxii, 3, pp. 179–192, 1 fig., 1 graph, 1941.

Experiments are described in which comparative measurements were made of apparent photosynthesis and of respiration in healthy bean (*Phaseolus vulgaris*) leaves and bean leaves infected by *Colletotrichum lindemuthianum* and *Erysiphe polygoni*. The results showed that leaflets infected by the former fungus assimilated 24 per cent. less carbon dioxide than healthy companion leaflets, and were restricted in growth (i.e., rate of increase in leaf area) by approximately 1·6 per cent., both differences being statistically significant. *E. polygoni* did not reduce normal assimilation until yellowing due to infection had set in. Diseased leaflets frequently abscissed prematurely while dark green and turgid. No significant difference was found between leaves affected by either fungus and healthy leaflets in respect of respiration.

Gorter (G. J. M. A.). **Chocolate spot of Broad Beans.**—*Fmg S. Afr.*, xvi, 182, pp. 167–168, 4 figs., 1941.

The sclerotial and spore dimensions of the fungus isolated from broad beans affected by chocolate spot in the western Cape Province, South Africa, are stated to correspond closely with those of *Botrytis fabae*, reported by Sardiña as the agent of a similar disease in Spain [*R.A.M.*, xi, p. 346]. Some strains of *B. cinerea* were found by Wilson to be capable of inducing chocolate spot symptoms [ibid., xvi, p. 723], but isolations of this species from olives and grapes gave negative results in the writer's inoculation tests on broad beans. A high degree of atmospheric humidity is essential for the development of chocolate spot in an epidemic form. Plants sprayed with spore suspensions of *B. fabae* and placed under bell-jars in a moist atmosphere reacted by the production of lead-coloured spots on the leaves within 24 hours. Wide

spacing of the plants and the use of well-drained sites are important means of counteracting excessive humidity.

EL-HELALY (A. F). **Further studies on the control of Bean rust with some reference to the prevention of chocolate spot of Beans.**—*Bull. Minist. Agric. Egypt* 236, 24 pp., 1939. [Received July, 1941.]

In continued experiments from 1937 to 1939 on the control of broad bean rust (*Uromyces fabae*) in several localities of Lower and Middle Egypt [*R.A.M.*, xviii, p. 567], with incidental reference to the prevention of chocolate spot (*Botrytis fabae*) in the same host [ibid., xvii, p. 646], Bordeaux mixture and bouisol gave the best results in respect of both diseases, the net profit accruing from the treatments ranging from £1 to £4 (Egyptian) per feddân [1 feddân = 0·42 hect.]. Lime-sulphur was less effective than the copper-containing mixtures, while wettable sulphur, kolofog, and kolodust were of little value for the object in view. Of the concentrations of Bordeaux mixture tested (0·25, 0·5, and 1 per cent.) the most effective and most profitable were the higher ones. Three applications of the 1 per cent. mixture reduced rust and chocolate spot from 100 per cent. each in the control to 36 and 33 per cent., respectively, in one experiment and four applications from 100 per cent. each to 10 and 12 per cent., respectively, in another. Even in seasons of low rust incidence spraying with 0·5 per cent. Bordeaux may be regarded as a profitable investment. In Middle Egypt the treatments should be carried out over a period of four to six weeks, commencing immediately upon the detection of rust or chocolate spot in the district and continuing practically up to maturity, while in the lower part of the Delta the schedule should be extended up to six or eight weeks. *U. fabae* generally makes its appearance in Middle Egypt during the first half of February, and *B. fabae* in Lower Egypt about the beginning of January, and these are the critical periods for the initial application of the fungicides. Pumps of the Bean Junior type have been found effective in combating rust and chocolate spot in large-scale field trials.

OGILVIE (L.) & WALTON (C. L.). **Diseases and pests of Onions and Leeks.**—*Worcs. agric. quart. Chron.*, ix, 2, pp. 57, 59, 61, 63, 65, 1941.

Popular notes are given on the following diseases affecting onions or leeks (or both) in the English Midlands: smut [*Urocystis cepulae*], particularly severe on White Lisbon onions and included in the Ministry of Agriculture's schedule of notifiable diseases; white rot [*Sclerotium cepivorum*], to which Up-to-Date, Rousham Park Hero, Improved Reading, and White Spanish onions are moderately resistant, leeks being only occasionally attacked; downy mildew [*Peronospora schleideniana*], to which both foliage and bulbs of the Up-to-Date onion are highly resistant; yellow dwarf [see next abstract], prevalent in England in 1940 on shallots [*Allium ascalonicum*], whence the virus is transmissible by aphids to onions, jonquils (*Narcissus jonquilla*) being also reputedly susceptible; and white tip of leeks [*Phytophthora porri*], first reported from Edinburgh in 1928 and since observed in several parts of England [*R.A.M.*, xix, p. 194].

TATE (H. D.). **Insects as vectors of yellow dwarf, a virus disease of Onions.**—*Iowa St. Coll. J. Sci.*, xiv, 3, pp. 267–294, 1940.

The distribution of onion yellow dwarf [*R.A.M.*, xix, p. 511] in Iowa is stated to be largely confined to the Pleasant Valley district, owing possibly to the fact that the commercial onion crop in this district is grown from sets, which constitute the principal over-wintering source of the virus. The disease is absent from areas where crops are produced from seed, the virus not being seed-borne. The virus is not known to attack any plant other than the cultivated onion, but it is believed that eventually additional hosts will be found. In transmission experiments with over 30 varieties of cultivated onion, the virus was transmitted from diseased to healthy plants by 48 species of aphids, whereas transmission tests with other insects, with two doubtful exceptions, gave negative results. The incubation period of the virus in the plant was relatively short, ranging mostly from 7 to 12 days with an average of 10·3. Extremely short feeding periods on a diseased plant were found sufficient to render the aphid vectors infective, and they were capable of transmitting the virus to healthy plants immediately thereafter. There was either none or an extremely short (only a few minutes) incubation period of the virus in the vector, and the infective power was lost within a few hours when aphids were fed on healthy susceptible, or immune hosts, or confined without food. Plants with masked symptoms of the disease were capable of serving as a source of infection and the disease could be transmitted from them by vectors to healthy plants. Field observations showed that the aphids were present in sufficient numbers and at the proper time to play an important part in field dissemination of the disease. Control should mainly aim at using disease-free sets and the destruction of diseased bulbs left over from the previous year. Transmission experiments with a large number of other plants (including shallot and jonquil) gave negative results.

GIBBS (J. G.), BAYLIS (G. T. S.), & BLACKMORE (L.). **Experiments in control of Onion-smut (Urocystis cepulae Frost).**—*N.Z. J. Sci. Tech.*, A, xxii, 3, pp. 162–166, 1 fig., 1941.

During 1939 onion smut (*Urocystis cepulae*) was observed on eight more properties in the Canterbury (Marshland) district of New Zealand, where it was first recorded in 1938 [*R.A.M.*, xviii, p. 82]. All the various formalin drip treatments tested for the control of the disease reduced the incidence of infection by 50 to 75 per cent., the 1 to 1·6 per cent. formulas being generally superior to those containing only 0·8 per cent. of the fungicide. Lime-sulphur as a drip treatment proved inferior to formalin, while formaldehyde dusts and mercurials were ineffectual. Attempts at the chemical disinfection of the soil were likewise unsuccessful.

REYES (G. M.) & ROMASANTA (R.). **Varietal susceptibility of Peanuts to black spot (Cercospora personata (B. & C.) Ell. & Ev.).**—*Philipp. J. Agric.*, xi, 4, pp. 371–381, 5 pl., 1 graph, 1940.

In addition to the organs already known to be susceptible to black [leaf] spot of groundnuts (*Cercospora personata*) in the Philippines

[*R.A.M.*, xviii, p. 433], the writers detected the presence of the fungus on the 'pegs' [embryonic organs at the lower end of the hypocotyls], where it directly obstructs the conveyance of the elaborated nutrients required for the normal development of the pods, and other parts of the aerial system.

Well-marked differences in reaction to infection by *C. personata* were observed among the 13 varieties investigated from this standpoint, the number of spots on Tai-tau, for instance, ranging from 2·28 to 33·82 per $\frac{3}{4}$ in. sq. at the time of maximum incidence, while the corresponding figures for Macapno were from 8·09 to 79·50, the averages of three counts for the two varieties being 14·92 and 36·97, respectively. Besides Macapno, the Cayagan No. 1, Vigan Lupog, and Biit varieties may be classed as highly susceptible, six are intermediate, and two, San José No. 3 and Tai-tau, are resistant.

McLean (D. M.). **Studies on mosaic of Cowpeas, Vigna sinensis.**—*Phytopathology*, xxxi, 5, pp. 420–430, 1 fig., 1941.

Cowpea mosaic, first reported from Arkansas in 1921 (*Phytopathology*, xi, pp. 146–148), has since been detected in Indiana, Louisiana, Oklahoma (with which State the present studies are concerned), Georgia, Mississippi, Iowa, Kansas, and New Jersey. The most conspicuous symptoms, including dwarfed, slender growth and a tendency to excessive branching, being displayed by such highly susceptible varieties as New Era, Whippoorwill, and Rice Pea, which in seed transmission tests conveyed infection to 5, 4·5, and 6·8 per cent., respectively, of their progeny, the corresponding figures for the comparatively resistant Red Ripper, Black, and Iron being only 0, 0, and 1 per cent., respectively.

Cowpea mosaic is transmissible by mechanical methods from diseased to healthy plants, the use of carborundum powder as an abrasive assisting in the development of a high percentage of infection. According to Chester, however, 100 per cent. regularity is not obtainable by mechanical means (*Plant Dis. Reptr*, xxiii, [p. 247], 1939). The virus was further transmitted in cage experiments by an unidentified black aphid, *Macrosiphum solanifolii*, *Aphis gossypii*, and *M. pisi* to the extent of 100, 60, 100, and 70 per cent., respectively. *M. pisi* and mechanical inoculation were instrumental in the conveyance of the cowpea mosaic virus to Wood's Prolific Lima beans (*Phaseolus lunatus* [var.] *macrocarpus*), but a number of other Leguminosae and Solanaceae reacted negatively to transmission experiments.

The cowpea mosaic virus remained infective after ageing *in vitro* for periods up to and including 48 hours. Its thermal inactivation point lies between 72° and 75° C., and infectivity was lost at dilutions exceeding 1 in 1,000.

Heinze (K.) & Köhler (E.). **Die Mosaikkrankheit der Sojabohne und ihre Übertragung durch Insekten.** [The mosaic disease of the Soybean and its transmission by insects.]—*Phytopath. Z.*, xiii, 3, pp. 207–242, 17 figs., 1940.

A mosaic disease identical with, or at least closely related to, that described for North America [*R.A.M.*, xix, p. 256] has been repeatedly observed in soy-bean plantings in Germany. Samples of seeds harvested

from these stands contained a relatively high percentage of infected material resulting in 40 per cent. infection in plants grown from these seeds. Sap transmission of the virus, using carborundum powder, was uniformly successful, a dilution of 1 to 10,000 still causing infection, but not one of 1 to 100,000. The lethal temperature for the virus in the sap was 61° C. In unpurified sap the virus remained viable for three to four days when kept at a room temperature of 21° to 23°. The virus was transmissible by the rubbing method to beans and vetch, but it did not seem to progress from the inoculated leaves into the other parts of the plants; attempts to transmit it to garden and field peas and *Vicia villosa* gave negative results. The symptoms showed rather striking differences, indicating that the virus has several variants. One particularly necrotic type was observed causing brown lesions on the rubbed leaves three days after inoculation. The virus was successfully transmitted by the following insects: *Doralis* [*Aphis*] *frangulae*, *D.* [*A.*] *rhamni*, *D.* [*A.*] *fabae*, *Macrosiphum solanifolii*, *Myzus ornatus*, *Neomyzus* [*M.*] *circumflexus*, *Aulacorthum pseudosolani* [*Macrosiphum solani*], and *Myzodes* [*Myzus*] *persicae*, the last two achieving 100 per cent. infections and needing less than 30 minutes' feeding on both the infective and the healthy plant. Infectious aphids were capable of transmitting the virus after eight hours of starvation, but they lost their infectivity when feeding in the interval on either healthy soy-bean plants or crops resistant to the virus. Measures recommended for the control of soy-bean mosaic comprise eradication of diseased material in plots planted for seeds, isolation of such plots from infested fields (possibly through protective belts of some other crop), transference of seed growing to districts known to be free from aphids (e.g., north-eastern Germany), seed control and selection, and earlier dates of sowing as far as weather conditions and varietal characteristics allow.

VIÉGAS (A. P.). **Manchas das fôlhas da Mandioca, produzidas por Cercosporas.** [Leaf spots of Cassava produced by species of *Cercospora.*]—*Bragantia* (*Bol. téc. Inst. agron. S. Paulo*), i, 3, pp. 233–248, 4 pl. (2 col.), 1941.

The available information concerning the distribution, economic importance, symptomatology, etiology, life-history of the agents, and control of the cassava leaf spots caused by *Cercospora henningsii* [*R.A.M.*, xvii, p. 296] and *C. caribaea* [ibid., xx, p. 286] is summarized, with special reference to the environmental conditions prevailing in the State of São Paulo, Brazil. Marcus (*Tropenpflanzer*, xxxviii, pp. 144–157, 1935) recommends Bordeaux mixture for the control of *C. henningsii*, and in the writers' preliminary experiments this preparation was tolerated even by young shoots at a strength of 1 per cent. Among the varieties susceptible to *C. henningsii* in São Paulo are Vassourinha, Bujarra, Mata-negro, Cruvela, and Atalaia, while *C. caribaea* severely attacks Assú, Mata-fome, Olanda-branca, and Vassourinha, Macaé being highly resistant in the Ubatuba district. Synonyms of *C. henningsii* [*R.A.M.*, v, p. 144] include *C. cearae*, *Helminthosporium manihotis* and *H. hispaniolae*, while *Ragnhildiana manihotis* Stev. & Solh. [ibid., xi, p. 130; xv, p. 59] is regarded as a synonym of *C. caribaea*.

RAGLAND (C. H.). **Muscadine Grapes respond to potash.**—*Bett. Crops*, xxiv, 10, pp. 9, 44, 2 figs., 1940.

By 1935, most of the 147 vines of 20 varieties planted at the Mississippi Agricultural Experiment Station in 1921 had fallen into a low state of vigour, inducing severe leaf scorch and chlorosis [*R.A.M.*, xx, p. 101] each year at midsummer. In May, 1938, the vineyard was divided into six plots, of which (1) and (4) received 2 lb.per vine, of each of the following: sodium nitrate, potassium chloride, and superphosphate, (2) and (5) of the two first-named constituents only, and (3) and (6) of soda only. On 21st September following, plots (1), (2), (4), and (5) each received 1 lb. potassium chloride per vine. On 21st April, 1939, and 26th April, 1940, the same treatments were given as in May, 1938, but at half rates. An immediate improvement was observed in the potash-treated plots, the incidence of leaf scorch in which on 17th July, 1939, was only 8 per cent. compared with 28 per cent. in those receiving nitrogen only, while by 26th September, 1940, the vines in the potash-treated plots were completely free from leaf scorch as against 54 per cent. affected in the checks. One type of chlorosis, commencing at the leaf margins and apparently representing the incipient stage of leaf scorch, was effectively combated by the potash treatments, to which the interveinal form of the disturbance, however, failed to respond by more than a temporary delay in the appearance of the symptoms.

WILLIAMS (P. H.), WHITE (H. L.), & SELMAN (I. W.). **Plant diseases.**—*Rep. exp. Res. Sta. Cheshunt, 1940*, pp. 41–48, 1941.

In this report [cf. *R.A.M.*, xix, p. 516] P. H. Williams states that in June, 1940, of eight tomato plants received from Guernsey four yielded *Fusarium bulbigenum* var. *lycopersici* and four others *Verticillium albo-atrum*.

The Lobjoit's Improved variety of Cos lettuce was attacked by *Botrytis cinerea*, infection generally beginning at the edge of a heart leaf and spreading to the heart, which became completely rotted. The disease may have been favoured by over-dry soil, leading to water shortage and tissue collapse.

Investigations by H. L. White on root rot of French beans [*Phaseolus vulgaris*] showed that the disease is characterized by a reddish canker at the base of the stem, associated with stunting, leaf yellowing, and wilt. Two types of *Fusarium* were isolated from affected plants with sufficient consistency to justify the view that at least one is implicated in the early stages of the disease. Type A is a rather slow-growing fungus with sparse aerial mycelium and extensive blue pionnotes (on media with a high sugar content), while, under similar conditions, type B is a relatively quick-growing fungus with abundant aerial mycelium and yellow-green sporodochia. Inoculations of French bean plants with spores of type A strains invariably resulted in the production of a reddish canker at the base of the stem resembling that given by inoculation with mycelium of a non-sporing type culture of *F. solani* var. *martii* f. 3. The evidence indicated that control would be possible if the plants could be kept healthy in the seedling stages, by sowing in sterilized soil or peat and planting out into the houses with the stem protected by the rim of a bottomless pot.

I. W. Selman inoculated Potentate tomato plants growing in a cucumber house under conditions closely approximating to those of nursery practice with (*a*) a severe-mottle streak virus, which tended to induce stem streaks, (*b*) a mild-mottle streak virus (A 15), which seldom induced streaks, and (*c*) mild tobacco mosaic (TbV1 J. Johnson), which normally induced a faint, greenish leaf mottle in tomato. The percentages of flowers setting fruit in plants affected by the three diseases were, respectively, 72·5, 77·4, and 78·6 per cent., as compared with 83·9 per cent. in the controls, while the relative losses in fruit set for the three diseases were, respectively, 13·6, 7·7, and 6·3 per cent. In the severe-mottle streak group 6·6 per cent. by weight of the fruit was blotchy as compared with 3·4 per cent. in the controls.

Nearly every fruit from virus-infected plants showed faint irregularities in colour. The more severe symptoms were (1) sunken pits (which bore no simple relation to the presence of any one of the viruses), (2) dull greenish-red fruits with granular pigmentation, (3) highly glazed surface of fruit, with granular pigmentation, (4) orange or yellow blotches, and (5) longitudinal yellow streaks. Plants infected with cucumber virus 1 produced some fruits with a distinctive green and red mosaic pattern, the coloured areas being sharply demarcated; no pitting was present. Other plants containing this virus produced fruits with irregular, glazed, whitish areas. Neither of these fruit effects appeared on plants infected with the streak or tobacco virus. Certain plants infected with a streak virus (either mild- or severe-mottle) showed successively or in conjunction a considerable range of symptoms on one and the same plant.

The cash losses per acre in 1938 caused by severe-mottle streak, tobacco mild mosaic, and mild-mottle streak, amounted on the basis of these experiments and 1938 prices to £300. 9*s*., £254. 6*s*., and £185. 5*s*., respectively.

NANDI (H. K.). **Appendix II. Annual Report of the Economic Botanist, Assam, for the year 1939–40.**—*Rep. Dep. Agric. Assam, 1939–40,* pp. 85–138, 1941.

In the section of this report (pp. 130–138) dealing with plant disease investigations in Assam during the period under review, it is stated that potato plots were heavily infected with *Cercospora concors* [*R.A.M.*, xix, p. 6], but spread was arrested by spraying with Bordeaux mixture (5–5–50). Bananas were affected by bunchy top [ibid., xix, p. 584], to which the Jahaji variety seemed very susceptible. Considerable damage was caused to jute by stem disease (*Diplodia corchori*) [ibid., i, p. 21; xx, p. 167] in the Surma valley and at Nowgong, while infection also appeared in an experimental plot at Jorhat, where, however, it was controlled by roguing before the spores developed. Rice in the Golaghat subdivision was heavily attacked by *Cephalosporium oryzae* [cf. ibid., ii, p. 259] in association with insect infestation. Severe and extensive damage was done to rice in several villages by *Sclerotium oryzae* [ibid., xv, p. 313] in association with *Helminthosporium* sp. Many sugar-cane fields in the Assam valley are regularly infected by *Cercospora kopkei* [ibid., xviii, p. 500], and appreciable injury was caused in many sugar-cane plots by *Fusarium moniliforme* [*Gibberella fujikuroi*: ibid., xix,

p. 583]. The groundnut varieties shan (Magura) Cawnpore No. 23 and M. 30/38 were found to be resistant to *C. personata* [see above, p. 443].

Hopkins (J. C. F.). **Annual Report of the Branch of Plant Pathology for the year ending 31st December, 1940.**—8 pp., Salisbury, Office of the Senior Plant Pathologist, Department of Agriculture [Southern Rhodesia], 1941. [Mimeographed.]

In this report on plant disease work in Southern Rhodesia in 1940 [cf. *R.A.M.*, xix, p. 642], the author states that barley mildew was very severe in Umtali district, seriously affecting the yield of the crops by preventing the stooling out of the young plants; perithecia of *Erysiphe graminis* were found for the first time upon disintegrated basal leaves.

Maize seed showed distinct improvement as compared with the preceding year in regard to *Diplodia* [*zeae*] infection [ibid., xix, p. 642]. That some maize plants were barren and red was found to be partly due to fungi of the *Diplodia* group, particularly *Gibberella saubinetii*, attacking the stem near soil-level. *Helminthosporium turcicum* was isolated from stalk infections.

*Antirrhinum* [*majus*] rust (*Puccinia antirrhini*) has been reported only once, and it is suspected that infection was brought into Rhodesia on the seed, since the outbreak occurred in a garden the owner of which has never introduced plants from outside the Colony. Numerous samples of seed from the United States, Great Britain, and the Union of South Africa were examined, and all were found to contain a high proportion of the uredospores of *P. antirrhini*. Sowings from these samples did not, however, give infected plants [ibid., xx, p. 209]. All infected material has now been burned, and the culture of antirrhinums near the infected site discontinued for at least three years. In the Union of South Africa the disease was first reported in September, 1939 [ibid., xix, p. 350], since when it has spread, apparently, throughout the entire region, where it may become a limiting factor in antirrhinum cultivation.

A species of *Phomopsis* was isolated from dead, well-grown flamboyant trees [*Poinciana regia*], which appeared to be identical with the fungus previously obtained from dying branches and considered by Fawcett to be probably a strain of *P.* [*Diaporthe*] *citri*. The flamboyant fungus grew between the bark and the wood at the base of the dead trees, and also attacked the petioles of young trees about 2 ft. high, causing shedding of all except the uppermost leaves.

Roses from England developed a serious outbreak of canker (*Coniothyrium fuckelii*) and root rot, infection apparently being brought in on the plants.

Easter lily [*Lilium longiflorum* var. *eximium*] mosaic was found to be caused by cucumber mosaic virus 1 [ibid., xix, pp. 349, 474]. The disease was transmitted from lily to cucumber by juice inoculation and by *Myzus persicae*. The symptoms were not, however, produced in tobacco. Symptom-masking in Easter lily and cucumber was induced by high temperatures. The original lilies were brought to the laboratory early in autumn. Conspicuous mottling was apparent on the leaves, the

plants were stunted, the buds were distorted, and the perianth of the flowers split on opening.

Apple trees sprayed with zinc sulphate against little leaf [ibid., xix, p. 197] showed good response to the treatment, and the work is to be continued.

Severe crinkle [ibid., xviii, p. 604; xix, p. 717] was experimentally transmitted by means of the aphid *Capitophora fragariae* from diseased to healthy Royal Sovereign strawberries. The virility of this variety could not be maintained by roguing, and small hope is entertained of propagating it successfully in Rhodesia.

Mango mildew [*Erysiphe cichoracearum*: ibid., xvii, p. 121; xx, p. 414] was widely prevalent, but was completely controlled in some cases by sulphur dusting.

The *Corticium* stage of *C. solani* was observed for the first time in the stock seed-potato plot on the high lands above the Pungwe Gorge, apparently favoured by the high humidity and low temperatures prevailing in this locality.

The chief tobacco diseases were a widespread epidemic of wildfire [*Pseudomonas tabaca*: ibid., xx, p. 180] and local epidemics of rosette [ibid., xix, p. 643]. Many outbreaks of wildfire were due to the use of diseased, untreated seed, while in some cases infection had been brought about by native snuff being dropped in the lands or seed-beds. Spraying in the field reduced the outbreaks to small proportions, and control was considerably assisted by a sudden cessation of the heavy rains, followed by a rather prolonged spell of dry weather. Very few cases of heavy loss from wildfire were reported. Assessment of losses due to rosette was complicated by the presence of sooty mould following insect infestation. Some areas were severely affected, but in many districts infection was restricted to small patches. Drastic roguing checked the disease in some cases, but in others the growers reported that no benefit resulted. Brown spot (*Alternaria longipes*) [ibid., xx, p. 180] was again destructive on late tobacco, and is now firmly established throughout the Colony. Much damage was caused in some parts, but some control resulted from field spraying, which allowed the leaf to be left in the land to ripen before being reaped.

New records, other than those mentioned above, included *Isariopsis griseola* on French beans [*Phaseolus vulgaris*], mosaic of cabbage, dwarfing of cauliflowers, and rosette of turnips due to a crucifer virus, which did considerable damage, turnip black rot (*Bacterium campestre*) [*Xanthomonas campestris*] and mildew (*E. polygoni*), lettuce mosaic, spinach leaf spot (*Cercospora spinacea*), and maize black bundle (*Nigrospora* sp.).

**Plant diseases. Notes contributed by the Biological Branch.**—*Agric. Gaz, N.S.W.*, lii, 5, pp. 274–276, 3 figs.; 6, pp. 316–320, 6 figs., 1941.

The following new host records for New South Wales were made in March, 1941: downy mildew of vegetable marrow (*Peronoplasmopara* [*Pseudoperonospora*] *cubensis*), leaf blight of cucumber (*Macrosporium cucumerinum*) [*Alternaria cucumerina*: *R.A.M.*, x, pp. 431, 771], and snapdragon (*Antirrhinum majus*) wilt (*Verticillium dahliae*) [cf. ibid., xx, p. 118]. During April the last-named pathogen was also observed

on *Gerbera jamesonii*, while another new record for the State was *Cercospora sesami* on sesame [ibid., xvii, pp. 294, 296].

*Corticium vagus* (*Rhizoctonia solani*) [*C. solani*] on potato tubers may be controlled by the use of clean seed, quadrennial crop rotation, and ten minutes' immersion of the tubers in acidulated mercuric chloride.

Higgins (B. B.). **Botany.**—*Rep. Ga agric. Exp. Sta.*, *1938–39*, pp. 60–64, [? 1940]; *1939–40*, pp. 51–57, 1 fig., [? 1941].

In the first of these reports [cf. *R.A.M.*, xviii, p. 236] it is stated that conclusive evidence has been obtained that *Macrosporium* [*Alternaria*] *solani* may live over in the soil to a slight extent into the second year, and that tomatoes cannot safely be grown in an [affected] field in alternate years.

Non-winter-hardy pea varieties (208 different seed lots) were grown in pots in hot-beds covered with cloth and heated electrically just sufficiently to prevent freezing. The plants were inoculated with the black stem and leaf spot fungi (*Ascochyta pinodella* and *Mycosphaerella pinodes*) [ibid., xx, p. 211]; the plants of some varieties rapidly succumbed, while those of others, of which Austrian Winter proved to be one of the best, developed little infection until late in spring. Evidence was obtained that the black-stem fungi can live at least 13 months in old pea stems kept out of doors, and at least 18 months in dry pea stems. These fungi and also *Septoria pisi* can live for more than nine months in sterilized sand, clay soil, and composted soil. That these organisms can persist so long under such a variety of extreme conditions emphasizes the need for rotation. *M. pinodes* has been recovered from infected seed stored for 14 months, and under some storage conditions may live, apparently, for five years.

In the second report it is stated that three applications of sulphur dust markedly reduced groundnut leaf spot [*Cercospora* (*Mycosphaerella*) *arachidicola* and *C. personata* (*M. berkeleyii*): ibid., xix, p. 453] and leaf-shedding, and gave an average increase in yield of 168 lb. nuts per acre, or 16 per cent., while with four applications the figure was 206 lb. or 20 per cent. Other work indicated that sulphur entering the soil may have value as a direct nutrient or in releasing other nutrients needed by the groundnut plants.

Groundnut seed treatment in many cases gave significant increases in germination. Field surveys showed that poor yields in groundnuts are generally due to poor stand. In two replicated field sowings made in south Georgia in the spring of 1940, conspicuous improvement in field stand was brought about by dusting with ceresan at the rate of 3 oz. per bush. seed, this being especially the case with machine-shelled seed; with hand-shelled seed increase in germination was less, amounting to about 5 per cent.

In seed disinfection tests against *Macrosporium* stem canker and leaf spot [*A. solani*] of tomato, new improved ceresan at the rate of 1 oz. per 15 lb. seed, and new improved ceresan jr. (3 oz. per 10 lb.) gave perfect control of seed-borne infection, with little or no seed injury after several months' storage in the laboratory. Tomato seeds in dry storage were found to be completely free from viable *A. solani* spores after one year.

The most serious vetch (*Vicia* spp.) disease in Georgia is root rot (*Aphanomyces euteiches* and possibly other fungi) [ibid., xix, p. 709]. Observations during a severe outbreak in 1939 indicated that *V. villosa* and *V. hybrida* are resistant, while *V. sativa*, *V. monantha* [*V. calcarata*], *V. dasycarpa*, and *V. pannonica* are susceptible.

PERLBERGER (J.). **Gall diseases of deciduous fruit trees.**—*Yedeoth*, v, 1–2, pp. 31–41, 11 figs., 1939. [Hebrew, with English summary on p. 92. Received July, 1941.]

Stone fruit trees of all kinds in Palestine are subject to root and root-collar galls due to *Pseudomonas* [*Bacterium*] *tumefaciens*, from which pomes, on the other hand, are relatively free. In nurseries and orchards the disease may be prevented by immersion of the seedling roots in disinfectant solutions containing heavy metals, while a reduction in the incidence of existent infection may be effected by excision of the galls and antiseptic treatment of the resultant wounds. Isolated cases of 'tuberculosis' [knot] (*P. savastanoi*) were observed on olive trees. Brown knot of quinces is thought to be of physiological origin.

DOWSON (W. J.). **The identification of the bacteria commonly causing soft rot in plants.**—*Ann. appl. Biol.*, xxviii, 2, pp. 102–106, 1941.

The soft-rotting bacteria occurring in Britain include *Bacterium carotovorum* [*Erwinia carotovora*] (the commonest), *Bact. phytophthorum* [*E. phytophthora*: *R.A.M.*, xix, pp. 113, 360] apparently confined in nature to the potato, *Bact.* [*E.*] *aroideae*, reported on arum corms and hyacinth leaves, though in the United States it has a wider host range than *E. carotovora*, *Bact. rhaponticum* [ibid., iii, p. 628], apparently found only on rhubarb and restricted to Britain, and *Pseudomonas marginalis*, which causes lettuce marginal spot.

The author's method for isolating soft rot bacteria is to remove aseptically fragments of the decayed tissues by means of a wire loop or forceps and transfer them to tubes containing 5 ml. sterile water. In 20 minutes the bacteria have diffused out. A loopful of the suspension is streaked on to plates of bullock heart infusion agar of $P_H$ 6·8. After two to three days' incubation, transfers are made to slopes of the same medium from all colonies differing in appearance.

To demonstrate pathogenesis, densely turbid suspensions are made from these pure cultures by transferring a large quantity of the bacterial growth to tubes containing 5 ml. sterile water; after shaking, loopfuls are transferred from these to freshly cut surfaces of slices of onion or cucumber in Petri dishes containing plenty of water. At least one dish is kept as a control. Within 24 hours at room temperature any of the five bacteria mentioned above will have started to set up decay. Rotting is almost complete in three days when due to *E. aroideae*, *E. phytophthora*, or *P. marginalis*, and in five or six days when due to either of the other two. If neither the well-separated colonies on isolation plates nor the surrounding liquid of the rotted slices are greenish, it may be assumed that the organisms concerned are *Bacterium* [or *Erwinia*] and not *Pseudomonas*. The species can then be distinguished by their biochemical reactions and different pathogenic abilities, both of which are summarized. The rot of potato tubers caused by inoculation

with *P. marginalis* is characterized by a buff colour and some of the rotting of potato tubers in soil and in storage may be due to this organism.

Posnette (A. F.). **Swollen-shoot virus disease of Cacao. (Review of research work to November 1940.)**—*Trop. Agriculture, Trin.*, xviii, 5, pp. 87–90, 1 plan, 1941.

After briefly reviewing earlier investigations into cacao swollen shoot on the Gold Coast [*R.A.M.*, xx, p. 342], the author states that in numerous inoculation experiments by E. F. S. Shepherd with a strain of bacteria cultured from swollen tissues and with extracts of crushed swollen tissue no transmission was secured. In further budding work by the author [cf. ibid., xix, p. 521] three plants were budded after being kept for a year in insect-proof cages, and the first definite symptoms appeared three months later on all plants, though the controls remained healthy. Ten healthy uncaged plants in an uninfected plot were also budded, and all became affected, though all the untreated plants were healthy. At Aburi, ten miles from the nearest known case, 90 plants were budded with swollen shoot, and all developed characteristic chlorosis; when 18 had developed typical swellings all were destroyed.

The disease was found in two-months-old squirrel-sown seedlings under infected trees. As this suggested seed transmission, a test was made in insect-proof cages, using only dwarfed pods from trees almost killed by the disease. Conclusive evidence was obtained that some beans from infected trees carry the virus, and it appears that in any one dwarfed pod, either all or none of the beans are affected. No transmission was secured with beans from normal pods taken from infected trees.

Possible vectors include *Mesohomotoma tessmanii*, *Toxoptera aurantii*, and *H*[*eliothrips*] *rubrocinctus*, and of these only the first has given positive results in experimental work.

The first recognizable symptom [loc. cit.] is generally a chlorosis of the young leaves, which are mottled, and bear a fine mosaic. This mosaic may develop into a general chlorosis or rarely may be masked by further development of chlorophyll. Some defoliation may precede but usually follows chlorosis and subsequent flushes of growth are much reduced. The period between the first appearance of the mosaic symptoms and complete defoliation may be as short as four months but usually requires 9 to 12 months. Die-back follows rapidly after defoliation, but the main trunk may not die for a year or more. The characteristic swellings develop on vigorous growth and may sometimes appear on a basal chupon before the mosaic has developed. Trees in the early stages of infection fruit heavily but after defoliation starts few pods are formed.

Two types of swollen shoot are recognizable, the common form characterized by marked chlorosis, rapid die-back, and few swellings, and a 'mild' or 'Bisa' strain, accompanied by very little chlorosis, slow deterioration, and many pronounced swellings. Transmission of each type has been effected by budding.

All the evidence indicates that the disease is spreading with such

rapidity that other forms of die-back are masked by it. Infection nearly always precedes die-back. Control measures devised to cure drought die-back by improving the environment of the cacao are regarded as of little or no value against swollen shoot. The district for some 250 sq. m. round Akwadum is too severely infected to justify control. The most that can be done here is to restore forest conditions suitable for the re-establishment of cacao in the future.

Baker (R. E. D.), Crowdy (S. H.), & Thorold (C. A.). **Witches' broom disease investigations. I. Seasonal variations in intensity of infection and their effect on control methods.**—*Trop. Agriculture, Trin.*, xviii, 6, pp. 107–116, 7 graphs, 1 plan, 1941.

Observations from 1930 to 1934 on cacao witches' broom (*Marasmius perniciosus*) [*R.A.M.*, xix, p. 391] on the Marper estate, Trinidad, showed that in each year there was a well-marked maximum of broom production in February or March, and a slight secondary maximum in September or October. A well-marked minimum was apparent each July. Pod losses at Marper since 1932 have been low, the two highest totals being only 10 and 8·67 per cent., in 1939 and 1937, respectively. In 1934, many brooms were removed, but pod loss amounted only to 1·33 per cent. When, however, infection is very severe pod losses in individual pickings may rise to 80 per cent.

Evidence was obtained confirming the view that severe outbreaks are due to the presence of mushrooms in the affected field or its vicinity. Mushrooms generally form on brooms still attached to the tree, but they also occur on the leaves of brooms, diseased pods, and affected material lying on the ground. In a wet locality they are produced at all seasons, but most abundantly from September to January, inclusive. All the evidence [which is given in detail] indicated that mushroom production and resultant infection are favoured by wet districts and wet years.

A broom usually takes at least three months to produce sporophores and if the brooms were cut out every three months the disease would presumably be controlled. Such a measure has, however, proved impracticable since it is (1) expensive, (2) difficult to carry out, requiring more skilled labour than is often available, and (3) clashes with other operations, such as harvesting. The most practicable modification of this method of control would appear to consist in removing as many brooms as possible between May and August, when both broom formation and sporophore production are at their lowest, and this should be followed by another removal in October and November. This scheme requires testing at once, and if it proves ineffective, all attempts at direct control by removal of brooms will probably have to be relinquished.

Baker (R. E. D.). **Immortelle disease.**—*Trop. Agriculture, Trin.*, xviii, 5, pp. 96–101, 2 figs., 1941.

During recent years 'Anauca' (*Erythrina micropteryx*) and 'Bocare' immortelle (*E. glauca*) trees in Trinidad have shown severe infection

p. 69; xvii, p. 729]. The condition is widespread, but is particularly severe in the low-lying Sangre Grande and Manzanilla districts, where in 1928 the Bocare immortelles began to die off rapidly. Since then, hundreds of trees of this variety have succumbed, and the disease has also attacked Anauca immortelle, cacao, and *Hevea* rubber to a considerable extent. The fungus was observed once on 'bois canon' (*Cecropia peltata*) and is common as a saprophyte on cacao husk heaps.

The symptoms are essentially similar on immortelle, cacao, and rubber. The disease is one of the bark and not of the root On *E. glauca* the lesions may occur anywhere on the trunk, the main branches, the buttress roots, or the main roots. Infection has been found on branches 45 ft. above, and on the trunk and main roots beneath, the ground. Attacks are most frequent on the buttress roots at or near ground-level. The rhizomorphs occur in the bark and secondary phloem, or sometimes in the wood, there being generally a very thick mat of them in the cambial region. They are flattened and white, gradually turning mauve, purple, and finally blackish-purple.

Spores are produced abundantly in coremia and perithecia on the surface of the lesions. The coremia measure 3 to 10 mm. in height, and show dark red heads up to 3 mm. in diameter and white stalks. The 4-celled conidia measure approximately 50 by 14 $\mu$, are dark red in the mass, and are frequently immersed in a drop of fluid. The conidiophores show a swelling just below each conidium, and are interspersed with long, septate paraphyses. The perithecia are superficial, pale greenish-yellow, and densely cespitose. The ascospores are similar in size to the conidia but bicellular and conspicuously striate.

As the large size of the spores would appear to preclude air distribution, it seems probable that the disease is most commonly spread by water and by the movement of debris containing spores or mycelium. Infection probably takes place through wounds in the bark of the trunk and main roots.

Successful inoculations with mycelium from cultures and living bark, and conidia were made on both species of immortelle, the fungus being readily reisolated from the diseased material. Inoculations on cacao gave negative results and only about 25 per cent. of all inoculations made were successful. These results indicate that the fungus can parasitize only unhealthy or damaged trees. The disease is never likely to be serious on rubber, cacao, or *E. micropteryx*, which was more difficult to infect than *E. glauca*.

On rubber the only control required is periodic inspection of the trees and the removal of diseased lesions, with disinfection of the wounds. Heavily infected trees should be destroyed.

On cacao slight infections may be treated surgically. Heavily diseased trees should be destroyed. If the disease is rife, the conditions are probably too damp, or the field needs replanting. Control on *E. micropteryx* should follow similar lines. *E. glauca*, on the other hand, appears to be too susceptible to be of any value as a shade tree in the Sangre Grande and Manzanilla districts of Trinidad, and should be replaced by some other shade tree. Very old immortelle trees constitute a problem on cacao plantations even when healthy, and a policy of shade replacement in definite rotation before the trees become too large

might prove highly effective against the disease and in preventing damage by falling trees.

SIMMONDS (P. M.). **Rootrots of cereals.**—*Bot. Rev.*, vii, 6, pp. 308–332, 1941.

In this paper, to which a bibliography of 104 titles is appended, the author briefly reviews and discusses some of the trends which have appeared in recent years in research work on cereal root rots caused by *Ophiobolus graminis*, *Cercosporella herpotrichoides*, *Helminthosporium sativum*, *Colletotrichum graminicola*, and other fungi [cf. *R.A.M.*, xix, p. 660].

D'OLIVEIRA (B.) & DE SOUSA (M. C. F.). **Raças fisiologicas da Puccinia graminis tritici em Portugal.** [Physiologic races of *Puccinia graminis tritici* in Portugal.]—*Agron. lusit.*, ii, 3, pp. 243–252, 1940. [English summary.]

Collections of wheat leaves and culms bearing uredosori of *Puccinia graminis tritici*, made throughout Portugal [*R.A.M.*, xx, p. 353] from 1937 to 1939, yielded six physiologic races of the rust, namely, 14 (predominating), 15, 24, 27, 40, and a new one, isolated only twice from material obtained in the extreme south, designated 187, characterized by heavy infection on the Jenkin and Marquis varieties, slightly less severe on Arnautka and Mindum, moderate on Reliance and Kota, slight on Spelmar, Kubanka, Acme, and Vernal, and very mild on Khapli, einkorn [*Triticum monococcum*] being immune. A table is given showing the reaction to races 24, 27, and 40 of a number of Portuguese wheats.

YARKINA (Mme A. M.). Расовый состав бурой ржавчины по Саратовской области в 1938–39 гг. [Races of brown rust in the Saratoff region in 1938–39.]—*Socialist. Grain Fmg, Saratoff, 1941*, 1, pp. 176–183, 2 figs., 1941.

Collections of wheat from 14 different localities in the Saratoff region, U.S.S.R., during the dry seasons of 1938 and 1939 yielded physiologic race 20 of *Puccinia triticina* previously reported from other parts of the Union, and a hitherto unobserved race, designated 109–C, the most prevalent in the region. The new race showed grade 1 infection in the differential varieties Mediterranean and Democrat, and grade 2 in the other six. Its presence was noted in samples from fields where races 10 and 65 had been found in previous years.

BROYAKOVSKY (N. V.). Поражаемость сортов озимой Пшеницы бурой листовой ржавчиной и сортов Овса корончатой ржавчиной. [The susceptibility of Winter Wheat varieties to brown leaf rust and of Oat varieties to crown rust.]—Научн. Зап. по Сахарн. Пром. [*Sci. Notes Sug. Ind.*], Kieff, [Grey Ser.], xvii, 1–2, pp. 87–99, 1940.

The results are computed of trials of wheat (160 varieties) and oats (69) tested in a number of experimental stations in the Ukraine for resistance to *Puccinia triticina* and *P. coronifera* [*P. coronata*], respectively. None of the varieties tested was absolutely resistant to rust, but the most promising wheats were 074 Lessostepka, 055, and

037 from the Belaya Tzerkov Station; 6–66, 6–86, and 6–176 from Vessely Podol; 0, 9, 010, and 013 from Verkhnyatchka; 054, 080, and 0153 from Nemertchanskaya; and 27/24 F 8L/3, and 27/24 F 84/3 from Mironovo; the best oats were 682–23 from Vessely Podol; 26–2015, 26–1655, and 26–1363 from the Mironovo Station; and 339 2/24 and 528 2/24 from the Verkhnyatchka Station. The author stresses the progress made in the production of disease-resistant wheats and to a lesser extent of oats during the period of the observations (1929 to 1937).

Yarkina (Mme A. M.). Физиология больного растения при поражениях ржавчиной **(Puccinia triticina)** в условиях орошения. [The physiology of the diseased plant infected with rust (*Puccinia triticina*) as affected by conditions of watering.]—*Socialist. Grain Fmg, Saratoff, 1940*, 4, pp. 137–150, 8 graphs, 1940.

In field and laboratory experiments conducted during 1934 at the Valouysk Experiment Station [south-east Russia] it was found that photosynthesis was much more intense in watered than in unwatered wheat. Weak infection with *Puccinia triticina* [*R.A.M.*, xix, p. 391] had a stimulating effect upon the photosynthesis (resulting in a maximum increase of 281 per cent. in watered and 430 per cent. in unwatered plants), whereas severe infection had the opposite effect, the average decrease in intensity amounting to 81 and 87 per cent. in watered and unwatered plants, respectively. Similar results were obtained in the previous year with sunflower infected with *P. helianthi* [ibid., xvi, p. 539]. The transpiration of weakly infected wheat leaves is increased by 20 to 60 per cent., while in severely infected ones it is two to three times more intense than in healthy ones. It appears from these facts that severe rust infection can induce a rapid exhaustion of the plant in so far as it considerably lowers the capacity of the plant to assimilate carbon dioxide from the air and at the same time considerably increases the loss of organic matter incurred in the process of transpiration. The increased rate of transpiration in even weakly infected plants leads to a greater demand for water and in consequence the stomata remain wide open, facilitating the penetration of the parasite into the plant, and thus favouring the development of severe infection in susceptible wheats. Another factor favouring infection is the intensified assimilation of carbon dioxide under the influence of watering, which ensures optimal conditions for the development of the fungus.

Johnston (C. O.) & Miller (E. C.). **Modification of diurnal transpiration in Wheat by infections of Puccinia triticina.**—*J. agric. Res.*, lxi, 6, pp. 427–444, 1 fig., 4 graphs, 1940.

Greenhouse studies [which are fully described] conducted over a period of three years on the effect of infection by *Puccinia triticina* [see preceding abstract] on the transpiration of a resistant and a susceptible variety of spring wheat showed that rusted, susceptible plants of Pusa No. 4 variety transpired 13·17 and 32·7 per cent. more than the healthy controls for periods aggregating 48 hours in two seasons, respectively. On the other hand the rate of transpiration of the resistant plants (Pusa 52×Federation in 1935 and Reward in 1936) was little affected by the rust (+5·05 and −1·6 per cent., respectively). The

diurnal rhythm of transpiration was seriously disturbed in the rusted, susceptible plants, which transpired much more than the healthy controls during the night. In two seasons this nocturnal increase over the controls was 83·41 and 89·62 per cent. respectively. The higher transpiration rate of affected plants at night appeared to be due partly to transpiration through ruptures in the cuticle caused by the uredosori and partly to the transpiration of the fungus itself.

STANFORD (E. H.). **A new factor for resistance to bunt, Tilletia tritici, linked with the Martin and Turkey factors.**—*J. Amer. Soc. Agron.*, xxxiii, 6, pp. 559–568, 2 graphs, 1941.

A tabulated account is given of the writer's studies at the University of California on the genetics of the inheritance of resistance to bunt (*Tilletia tritici*) [*T. caries*] (race III of Reed [*R.A.M.*, viii, p. 488] or T–1 of Rodenhiser and Holton [ibid., xvii, p. 165]) in the Rio, C.I. 10061 hard red winter wheat variety. During the seven-year period since the introduction of this variety into the nursery at Davis, its average incidence of infection has been 1·2 per cent., with a maximum of 5·8 in 1937. Rio was crossed with (1) the highly susceptible white Baart, (2) Turkey 3055, (3) Selection 1403, and (4) Martin. The existence of a new factor for bunt resistance was demonstrated in Rio, to which the symbol RR has been assigned; when present in the heterozygous condition this factor permits some 50 per cent. infection of the plants. The factors present in Baart modify the influence of Rio, allowing the development of a small percentage of bunt (9·3). The crosses between Rio and (a) Selection 1403 and (b) Turkey yielded further evidence that a single factor controls the resistance of the first-named: it was shown to be closely linked with the factor operative in Turkey and more remotely with that governing the reactions of Martin.

El Khishen, in an unpublished investigation with the same race of bunt, discovered an additional factor in Turkey 10016 which he designated XX, while Turkey 10015 was found to contain a weak factor, YY.

TANAKA (I.). **Phytophthora macrospora (Sacc.) S. Ito et I. Tanaka on Wheat plant.**—*Ann. phytopath. Soc. Japan*, x, 2–3, pp. 127–138, 7 figs., 1940. [Japanese, with English summary.]

The conidial stage of the fungus herein referred to *Phytophthora macrospora* (Sacc.) S. Ito & I. Tanaka nov. comb. (syn. *Sclerospora macrospora* [*R.A.M.*, xiii, p. 804], *S. kriegeriana*, and *S. oryzae* [loc. cit.]) was first observed on rice by Tasugi in 1927 and transferred by him to *Nozemia*. In 1937 the author detected the same phase of the organism on wheat plants severely attacked by downy mildew following a flood in Hokkaido. The conidia measured 57·5 to 97·5 by 30 to 65 (average 74·6 by 46·8) $\mu$ on the plant, but when the leaves were soaked in water elongated to 65 to 112·5 by 32·5 to 55 (87·37 by 43·75) $\mu$, the latter dimensions agreeing with those reported by Tasugi; production took place in abundance at 11° to 24° C. The oogonia of *P. macrospora* in wheat tissues measured 55 to 100 by 50 to 95 (69·12 by 65·13) $\mu$, the paragynous antheridia 22·5 to 41·25 by 12·5 to 22·5 (27·75 by 15·15) $\mu$,

the oospores 42·5 to 72·5 by 42·5 to 70 (60·25 by 56·67) μ, and the zoospores 12·5 to 16·25 by 10 to 12·5 (14·17 by 10·8) μ.

Zanevicz (V. E.). Влияние гриба **Trichoderma lignorum** на нарастание прочности структуры почвы и урожайность озимой Пшеницы и Овса. [The influence of the fungus *Trichoderma lignorum* on the consolidation of soil structure and the yield of Winter Wheat and Oats.]—Научн. Зап. по Сахарн. Пром. [*Sci. Notes Sug. Ind.*], Kieff, [Grey Ser.], xvii, 1–2, pp. 122–125, 1940.

Soil inoculation with *Trichoderma lignorum* [*T. viride*: *R.A.M.*, xix, p. 322] in a field near Kieff, Ukraine, during 1938 considerably promoted the consolidation of soil structure and increased the yield of winter wheat by from 5·5 to 6·8 per cent. where the inoculation was carried out in spring and in autumn, and by from 13·3 to 14·0 per cent. where it was done only in autumn. Oats grew better on inoculated soil and gave an increase in yield of 6·5 per cent. when the soil was inoculated in autumn, and one of 4·7 per cent. when seeds were inoculated in spring.

Holton (C. S.). **Further studies on the Oat smuts, with special reference to hybridization, cytology, and sexuality.**—*J. agric. Res.*, lxii, 4, pp. 229–240, 3 figs., 1941.

Seven races of the buff type of oat smut were identified at Washington; one of them, a mutant from *Ustilago levis* [*U. kolleri*: *R.A.M.*, xv, p. 569], was collected in the field, another arose through mutation, and five through hybridization of buff races 1 or 2 with either *U. kolleri* or *U. avenae*. It appeared from the crossing experiments that new races of the buff smut could be produced at will by crossing any race of the buff fungus with races of the other two. The mature chlamydospores of the buff smut contained a single diploid nucleus. Meiotic division of this nucleus accompanied spore germination and each cell of the promycelium and each sporidium contained a single haploid nucleus. When sporidia of opposite sex fused, the nucleus from one passed into the other and thence the paired nuclei passed into the infection hyphae. It is presumed that the binucleate condition persists throughout the parasitic stage, nuclear fusion occurring when the spores become mature. The factor for powdery sorus type was dominant over that for indurate sorus type and the segregation and recombination of these characters occurred in a simple 3 : 1 ratio basis. Active or passive participation of sporidia in the fusion process appeared to be governed primarily by their 'physical' condition and not by sex. Thus, sporidia budding on plain agar responded more rapidly to the fusion stimulus than those on potato dextrose agar.

Gallagher (P. H.) & Walsh (T.). **Investigations on grey speck disease of Oats on some Irish soils.**—*Proc. R. Irish Acad.*, Sect. B, xlvi, 11, pp. 143–159, 4 pl., 1941.

Grey speck of oats has been observed in Co. Monaghan and at six centres near Dublin, mostly on grey or black loam soils of a slightly alkaline reaction and containing appreciable amounts of calcium carbonate. In pot experiments at University College, Dublin, the disease

was effectively combated by soil treatments with manganese sulphate [*R.A.M.*, xx, p. 251], at a rate equivalent to 100 lb. per acre (in solution), acid peat mould (one part per 20 of soil by weight), 1 per cent. tartaric acid, and formalin [amount not stated]. The development of the symptoms was prevented by the maintenance of an adequate supply of soil moisture, while drought accentuated the trouble. In manurial trials in pots the omission of potash from the dressing considerably mitigated the intensity of the disease, which was further shown by field experiments to be economically controllable by the application to the crop, towards the end of June, of a 1 per cent. manganese sulphate solution at the rate of 100 to 120 gals. (10 to 12 lb. of the salt) per acre, which increased the weight of the grain from $3\frac{3}{4}$ to $5\frac{5}{8}$ lb., and that of the straw from $6\frac{1}{4}$ to $8\frac{1}{4}$ lb., both calculated per sq. perch. Of the seven varieties included in a series of pot tests, the Scottish-grown Star was the most resistant, whereas Early Miller, also of Scottish origin, was highly susceptible; Glasnevin Success, Victory II, and *Avena nuda* were severely attacked in the early part of the season but made satisfactory recovery later. Potato oats were observed in the field to be very resistant, as already noted in Wales [ibid., xi, p. 295].

STEVENS (N. E.) & WILSON (W. E.). **A biotin-like substance produced by Diplodia zeae.**—*Science*, N.S., xciii, 2419, pp. 458–459, 1941.

In the course of a study at the University of Illinois on the physiology of the maize pathogens *Diplodia zeae* and *D. macrospora*, the former species was observed to produce a substance essential for the growth of both. A concentrate obtained from a synthetic medium which had been staled for four or five weeks by *D. zeae*, was found to possess properties very similar to those of biotin. In a medium prepared by autoclaving the white of a fresh egg and 10 ml. of an aqueous solution of a concentrate of the staled medium, adding the required aliquots of dextrose and minerals and then autoclaving again, both *D. zeae* and *D. macrospora* grew well; on the other hand, the growth of the former species was markedly reduced and of the latter completely inhibited when raw egg white (recently reported to inactivate biotin *in vitro*) was added aseptically to a 500 ml. of sterile medium containing 10 ml. of staled solution.

**Phytophthora disease.**—*Indian Fmg*, ii, 2, p. 83, 1941.

In tracts of heavy rainfall in Coorg, Madras, and Mysore, the loose-jacketed Coorg orange (*Citrus nobilis*), extensively grown at altitudes of 1,500 to 4,000 ft., is subject to severe infection by a species of *Phytophthora* attacking the foliage, young fruits, and stem bark. The attack usually begins in July, and heavy leaf-shedding and fruit drop take place during the peak of the south-west monsoon. Cankers are formed on the trunk and branches about December and January, when dew and mists are prevalent. All three forms of the disease were effectively combated in experiments in the Wynaad hills (Madras) by two applications of 1 per cent. Bordeaux mixture, the first in May to June, just before the outbreak of the monsoon, and the second in July, when fungal activity reaches a climax. The spread of bark cankers

may be arrested by scraping the wounds and treating them with Bordeaux paste.

RUEHLE (G. D.) & THOMPSON (W. L.). **Commercial control of Citrus scab in Florida.**—*Bull. Fla agric. Exp. Sta.* 337, 47 pp., 5 figs., 1939. [Received August, 1941.]

The following results were obtained in the writers' experiments, extending from 1934 to 1939, on the combined commercial control of citrus scab (*Elsinoe fawcetti*) and scale insects in grapefruit, Samson tangelo, and King orange groves [see next abstract] in Florida. Since the scab organism is perpetuated mainly on diseased foliage, there is a marked tendency for it to increase in severity if fungicides are withheld. The best time for the application of disinfectants appears to be during the period immediately preceding the spring flush, while in small groves good results have also been secured in the last of the bloom. In cases of severe infection of overwintered foliage, Bordeaux mixture 6–6–100 is recommended for the pre-growth spray, but 3–3–100 has given excellent control of scab on the new leaves where infection on the previous season's foliage was mild, and the latter strength should also suffice for bloom and post-bloom treatments provided a dormant treatment has been applied. Adequate protection against scab is usually conferred by the last-named treatment in mild cases.

Basic copper sulphate, copper hydroxide (40 per cent.), and ammonium copper silicate are equally effective with Bordeaux mixture for scab control if used in formulas containing the same amounts of metallic copper, and combine just as well with insecticides. On the other hand, lime-sulphur 4 in 100, with added wettable sulphur, gives only partial control of the disease in a moderate or severe form, and sulphur sprays fail to remove melanose [*Diaporthe citri*] blemishes from the fruits. Mercury-oil emulsions are similarly unreliable. Older trees attacked by both scab and melanose require two copper treatments, one dormant and another during or after the blossom.

FAWCETT (G. L.). **La verrucosis de los Citricos.** [Citrus scab.]—*Circ. Estác. exp. agríc. Tucumán* 94, 3 pp., 3 figs., 1940.

The following directions are given for the control of scab of sweet oranges (*Sphaceloma*) [*fawcettii* var. *viscosa*: *R.A.M.*, xvi, p. 95] and that of lemons and bitter oranges (*S.* [*Elsinoe*] *fawcetti*) [ibid., xix, p. 366 and preceding abstract] in Tucumán, Argentina: (1) an application of 0·75 per cent. Bordeaux mixture shortly before the commencement of flowering (end of August under local conditions); (2) a further treatment at 0·5 per cent. when most of the flowers have fallen. A later spray may be advisable in cases of heavy infection, but as a general rule its benefits do not outweigh the costs of material and labour. The application of Bordeaux mixture to the trees promotes the development of scale insects, for which reason an insecticide should be used a few days later. Attempts to combine the fungicidal and insecticidal operations in a single treatment by the admixture of an oil emulsion with the Bordeaux mixture proved unsuccessful, as regards the particular object in view, but demonstrated the value of the oil in procuring the uniform distribution of the liquid over the leaf surfaces.

[This paper also appears in *Rev. industr. agríc. Tucumán*, xxx, 10–12, pp. 227–229, 3 figs., 1940.]

CAMP (A. F.) & FUDGE (B. R.). **Some symptoms of Citrus malnutrition in Florida.**—*Bull. Fla agric. Exp. Sta.* 335, 55 pp., 8 col. pl., 11 figs., 1939. [Received August, 1941.]

The symptoms of copper, zinc, manganese, magnesium, nitrogen, iron, and boron deficiency in Florida citrus groves are clearly described and illustrated by means of excellent coloured plates and photographs. Reference has been made from time to time to a number of these disturbances, including die-back, associated with lack of copper [*R.A.M.*, xviii, p. 518], and frenching or mottle leaf [loc. cit.] (zinc deficiency).

LEROY (J. V.) & HENDRICKX (F. L.). **Contribution à l'étude des dégats causés par les Antestia aux Caféiers (Coffea arabica L.).** [A contribution to the study of the depredations caused by species of *Antestia* in Coffee (*Coffea arabica*) plantings.]—Reprinted from *Centre afr.*, *1941*, 393, 1 p., 1941.

The severe depredations inflicted by Pentatomidae of the genus *Antestia* (? *A. lineaticollis* or *A. faceta*) in the coffee plantations of the Belgian Congo are not confined to direct injuries by the insects themselves, but serve as channels of ingress for *Nematospora coryli* and possibly *Ashbya* [*N.*] *gossypii* [cf. *R.A.M.*, xii, p. 8; xiii, p. 114; xix, p. 72], while a species of *Fusarium* [ibid., xix, p. 330], associated with peduncle decay but incapable of provoking it unaided, and other fungi (species of *Pestalozzia* and *Mucor*) have been isolated by the authors from the rostra of the insects.

NAKAYAMA (T.). **A study on the infection of Cotton seedlings by Rhizoctonia solani.**—*Ann. phytopath. Soc. Japan*, x, 2–3, pp. 93–103, 3 figs., 1940. [Japanese summary.]

The invading hyphae of *Rhizoctonia* [*Corticium*] *solani*, inoculated into cotton seedlings in Petri dishes, proceeded along the slight depression in the epidermis above the junction of the epidermal cells of the root, hypocotyl, and cotyledon, the depression becoming intensified as the hyphae adhered more closely [*R.A.M.*, xi, p. 454]. The root tips proved very susceptible to infection, the fungus penetrating the epidermis and branching out inter- and intracellularly into the endodermal region. Permeation of the root was likewise effected through the natural injuries associated with the extrusion of new secondary rootlets from the tap root. 'Infection cushions' were the principal means of ingress into the hypocotyl, infection by simple hyphae occurring rarely. The cuticle and stomatal apertures served as sites of entry into the cotyledons, the lower surface being penetrated chiefly through the latter channel, while both types of infection were present on the upper side.

NISIKADO (Y.), KIMURA (K.), & MIYAWAKI (Y.). **On two Alternaria species injurious to Cotton fibre in balls.**—*Ann. phytopath. Soc. Japan*, x, 2–3, pp. 214–230, 7 figs., 2 graphs, 1940. [Japanese, with English summary.]

Two species of *Alternaria*, *A. macrospora* [*R.A.M.*, xix, p. 72] and

*A.* (?) *gossypii*, were recently found attacking cotton fibres in nearly mature balls in western Japan, the former also affecting the foliage while the latter is mostly confined to the fibres. The inoculation of cotton balls of varying degrees of maturity and of commercial and absorbent cottons resulted in discoloration or blackening of the fibres in all except the last-named. The minimum, optimum, and maximum temperatures for the mycelial growth of both species were 5°, 27° to 30°, and 36° C., respectively, and the minimum, optimum, and maximum hydrogen-ion concentrations $P_H$ 2, 5, and 10, respectively.

ADAIR (L. A.) & MOORE (ELIZABETH J.). **A photoelectric method and its use for determination of fungus growth rates.**—*Phytopathology*, xxxi, 5, pp. 448–452, 1 diag., 1 graph, 1941.

Details are given of an accurate and rapid photoelectric method for the determination of the amount of growth produced by the cotton root rot fungus [*Phymatotrichum omnivorum*]. The results secured by means of this technique agree closely with the data yielded by gravimetric methods for larger colonies, while for smaller ones the photoelectric instrument is more reliable.

REX (E. G.). **A promising fungous pathogen of adult Japanese Beetles (Popillia japonica).**—*J. N.Y. ent. Soc.*, xlviii, 4, pp. 401–403, 1940. [Abs. in *Rev. appl. Ent.*, Ser. A, xxix, 7, p. 368, 1941.]

When adults of *Popillia japonica* Newm., were dusted with the spores of *Beauveria bassiana* isolated from larvae of *Leptinotarsa decemlineata* Say [*R.A.M.*, xviii, p. 591], the percentage of infection in many cases reached 100 per cent. About 75 per cent. of adults allowed to feed on leaves sprayed with a dilute aqueous suspension of the spores became infected, as did 20 to 70 per cent. of healthy adults kept in close association with others previously exposed to infection. From this and similar evidence it is concluded that the fungus shows considerable promise as a means of controlling adults of *P. japonica*.

DRECHSLER (C.). **Four Phycomycetes destructive to nematodes and rhizopods.**—*Mycologia*, xxxiii, 3, pp. 248–269, 5 figs., 1941.

A new genus, *Cystopage*, is established for two new species belonging in the Zoöpagaceae, described as *C. lateralis* (capturing various nematodes) and *C. subtilis* (capturing rhizopods), respectively [*R.A.M.*, xix, p. 703]. Both species were found occurring in leaf mould in Wisconsin. Two amoeba-destroying species, *Acaulopage stenospora* and *Cochlonema symplocum*, are described from Virginia and Wisconsin, respectively.

MUSKATBLIT (E.). **Allergic manifestations of fungous diseases.**—*Med. Rec., N.Y.*, clii, 8, pp. 273–277; 9, pp. 314–317, 1940.

'Mycids' (defined as allergic manifestations produced by the action of fungi or their products on tissue made hypersensitive by a preceding fungal infection) have been found, in the author's New York practice, to be due mostly to *Epidermophyton* spp., notably *E.* [*Trichophyton*] *interdigitale*, *T. gypseum*, *T. faviforme*, *T. acuminatum*, *T. crateriforme*, *Microsporon lanosum* [*M. felineum*] (predominating in cases of tinea capitis), *M. audouini*, *Achorion schoenleini*, and *Monilia* [*Candida*]

*albicans*. The antigen, consisting of the organized fungal elements or toxins, is conveyed from the site of infection to the more remote parts of the skin by way of the blood stream, from which the pathogen may occasionally be isolated. Persons suffering from mycids almost invariably react positively to trichophytin injections.

SHARP (W. B.). **Extraction of antigen from molds.**—*J. invest. Derm.*, iv, 3, pp. 205–217, 1941.

The procedure adopted by the writer for the extraction of antigen from *Microsporon felineum* and *M. audouini* at the University of Texas Medical School was based on the dissolution of proteins from Sabouraud's broth cultures into a sodium chloride solution and salting them out with ammonium sulphate. The residue contains the antigen [cf. preceding abstract] capable of effecting immunization against the specific organism in animals. With the aid of these reagents, moreover, serologic groupings among the dermatophytes and related organisms may be established, and the following results were obtained in experiments on rabbits. A close relationship between the two above-mentioned *M.* spp. was apparent from the cross-precipitations of the serum, whereas the connexion between *Trichophyton mentagrophytes* and *T. rubrum* and the agents of microsporosis was much more distant, *T. epilans*, *M.* [*T.*] *gypseum*, and *E. floccosum* were barely, if at all, related to *M. felineum* and *M. audouini*, while no affinity whatever could be demonstrated between the two last-named fungi and saprophytes of the genera *Aspergillus*, *Penicillium*, *Hormodendrum*, *Fusarium*, and *Alternaria*.

BURT (K. L.) & KETCHUM (HELEN M.). **The classification of strains of Candida (Monilia) isolated from sputum.**—*Amer. J. trop. Med.*, xxi, 3, pp. 427–446, 1941.

From the sputa of 693 patients at the Michigan State Sanatorium the writers isolated 250 strains of *Candida* (36 per cent.), of which 205 (82 per cent.) were classified as *C. albicans*, 40 (16 per cent.) as *C. tropicalis*, 2 (0·8 per cent.) as *C. krusei*, while 3 (1·2 per cent.) remain unidentified. Of 15 strains received from Martin and Stovall, 3 were referred to each of the species *C. parakrusei*, *C. albicans*, and *C. tropicalis*, and 2 each to *C. krusei*, *C. stellatoidea*, and *C. pseudotropicalis* [*R.A.M.*, xx, p. 258]. Most of the strains were readily determined by the inoculation of malt agar plates and modified Durham tubes containing sucrose and maltose at 37° C. Fermentation tests were also used with predominantly consistent results, and intensive studies were made of the mycelial habits and giant colonies of the various species for differential purposes.

JOACHIM (H.) & POLAYES (S. H.). **Subacute endocarditis and systemic mycosis (Monilia).**—*J. Amer. med. Ass.*, cxv, 3, pp. 205–208, 7 figs., 1940.

A detailed account is given of the clinical aspects of a fatal case, believed to be exceedingly rare or unique, of subacute endocarditis and systemic mycosis in a 48-year-old male at Brooklyn, New York. The organism isolated from granulomata in the epidermal and subcutaneous

tissues agreed in cultural and morphological characters with *Monilia* [*Candida*] *psilosis*, but as the patient's serum reacted positively to authentic cultures of *M.* [*C.*] *albicans* the final identification of the pathogen awaits further study.

WEIDMAN (F. D.) & ROSENTHAL (L. H.). **Chromoblastomycosis: a new and important blastomycosis in North America; report of a case in Philadelphia.**—*Arch. Derm. Syph., Chicago*, xliii, 1, pp. 62–84, 4 figs., 1 map, 1941.

The fifth case of chromoblastomycosis for the continental United States is reported, occurring in a 44-year-old negress at Philadelphia. The causal organism was identified as *Hormodendrum pedrosoi* [*R.A.M.*, xx, p. 202]. The authors were unable to detect any *Phialophora* cups in their cultures of the fungus, but a few were detected by Carrión (personal communication) in cultures sent to him for examination. This record brings the known total of cases (nearly all in men) to 110 (41 in North America, including Cuba, Puerto Rico, San Domingo, Guatemala, and Costa Rica), 58 in South America, three in Europe (U.S.S.R.), two in Africa (one each in Rhodesia and Algeria), and six in Asia (three each in Japan and Dutch East Indies). The various fungi claimed to be causative in the disease possess the common property of appearing in the human skin as characteristic large, brown, sclerotic cells, so conspicuous and distinctive as to afford a ready means of microscopic diagnosis. A new feature in the authors' case was an 'encrusting' mantle round the fungus cells which stained pink in sectors.

KESSEL (J. F.). **Recent observations on Coccidioides infection.**—*Amer. J. trop. Med.*, xxi, 3, pp. 447–453, 1941.

This paper, read at the 36th Annual Meeting of the American Society of Tropical Medicine, held at Louisville, Kentucky, in November, 1940, embodies some outstanding recent observations, of predominantly clinical interest, on the two types of infection caused by *Coccidioides immitis* in California, namely, the benign 'San Joaquin Valley fever' and the much graver coccidioidal granuloma [*R.A.M.*, xx, p. 203], the death rate from the former being estimated at less than 1 and from the latter at 50 to 60 per cent.

MALLMANN (W. L.) & MICHAEL (CATHERINE E.). **The development of mold on cold storage Eggs and methods of control.**—*Tech. Bull. Mich. agric. Exp. Sta.* 174, 33 pp., 1 graph, 1940.

Representatives of ten genera of fungi were repeatedly isolated from eggs obtained during two seasons from cold storage plants and examined at the Michigan Agricultural Experiment Station, but species of only two—*Penicillium* [*R.A.M.*, xviii, p. 180] and *Hormodendrum*—were isolated from the interior of the shell, the *P.* species involved being *P. citro-roseum*, *P. asperulum*, *P. chloroleucon*, *P. ochrochloron*, *P. oxalicum*, *P. puberulum*, *P. citrinum*, *P. janthinellum*, *P. casei*, *P. crustosum*, *P. flavo-glaucum*, *P. viridicatum*, *P. verrucosum*, *P. roqueforti*, and *P. kapuscinskii*. A number of these were isolated from new and mouldy egg cases, which also bore *Chaetomium globosum*. The last-named and *Mucor racemosus* were also isolated from the boards of new cases. The

outer surface of the mouldy eggs yielded, in addition to the above-mentioned *P.* spp., *Aspergillus flavus*, *A. niger*, *Fusarium* sp., *M. racemosus*, *M. lausannensis*, *C. globosum*, and *Cephalosporium* sp.

Two groups of compounds were tested for their value as mycostatic agents in the control of egg moulds, comprising (1) those with little or no vapour tension, acting by contact with the mould spores or mycelium, and (2) those with a vapour pressure sufficient to convey the inhibitory action to the mould without direct contact. The antiseptics of the latter group proved to be most effective, notably sodium 2, 4, 5 trichlorophenate (dowicide B), sodium 2, 4, 5, 6 tetrachlorophenate (dowicide F), and sodium pentachlorophenate (dowicide G) [ibid., xix, pp. 289, 574], of which the first-named exerted the most powerfully fungicidal action but the last-named is recommended as the most satisfactory of the three preparations under ordinary commercial conditions, being superior from the standpoint of economy, slight odour, and a relatively low vapour pressure. Impregnation of fillers, flats, and cases was found to be the best method of applying the mycostat, which did not impair the odour or taste of the eggs stored therein.

Ikata (S.) & Yoshida (M.). **A new anthracnose of Jute Plant.**—*Ann. phytopath. Soc. Japan*, x, 2–3, pp. 141–149, 6 figs., 1940. [Japanese, with English summary.]

*Colletotrichum corchorum* Ikata & Tanaka n.sp. [without a Latin diagnosis] forms on jute (*Corchoris capsularis*) stems, leaves, and pods in the Kumamoto, Shizuoka, and Aichi Prefectures of Japan, brown to black, sharply defined lesions, and is characterized by a patelliform stroma, 100 to 350 $\mu$ in diameter and 25 to 50 $\mu$ in height, from the margin of which arise varying numbers of yellowish-brown to black, 2- to 5-septate setae, 36 to 117 by 3·6 to 5 $\mu$; simple, hyaline, conidiophores, 15 to 35 by 3 to 4 $\mu$; aud abundant non-septate, hyaline curved, bluntly tapering, oblong-fusoid to falcate-fusoid conidia, 12 to 25 by 3·6 to 6 (average 16 to 22 by 4) $\mu$. The optimum temperature for the growth of the fungus is 30° C. Its pathogenicity was demonstrated by inoculation experiments, the incubation period being about three days. *Colletotrichum corchorum* is a seed-borne parasite, the mycelium originating in the seed to the exterior of which the spores adhere.

Celino (M. S.) & Ocfemia (G. O.). **Two additional insect vectors of mosaic of Abacá, or Manila Hemp plant, and transmission of its virus to Corn.**—*Philipp. Agric.*, xxx, 1, pp. 70–79, 1 pl., 1941.

*Aphis gossypii* and *Rhopalosiphum nympheae* have already been shown by the first-named writer to be instrumental in the transmission of abacá [*Musa textilis*] mosaic in the Philippines [*R.A.M.*, xx, p. 65], and further experiments have demonstrated the agency of *Aphis maidis* from maize and *R.* (near *prunifoliae*) from *Paspalum conjugatum*, *Cynodon dactylon*, and other grasses in the conveyance of the disease from infected to healthy abacá plants, the incubation periods ranging from 8 to 15 days with *A. maidis* and from 7 to 15 with *R.* (near *prunifoliae*). *A. maidis* further transmitted the abacá virus to maize, the incubation period ranging from 4 to 13 days. The virus was recovered from the latter plant by the aphids and found to be still infectious to maize and abacá seedlings. The writers are of opinion that the trans-

missibility of abacá mosaic to maize denotes an affinity between this virus and that of cucumber mosaic.

Colhoun (J.) & Muskett (A. E.). **Powdery mildew, hail damage and heat canker of Flax.**—*Gdnrs' Chron.*, Ser. 3, cx, 2848, p. 30, 1 fig., 1941.

The fungus observed on flax plants showing the symptoms of powdery mildew in Northern Ireland in 1939 and 1940 was characterized by conidia measuring 35 by 14 $\mu$, borne singly or in short chains on the tips of conidiophores, and agreeing with Salmon and Ware's description of the imperfect stage of *Erysiphe polygoni*, found on the same host in the greenhouse at Cambridge in 1927 [*R.A.M.*, vi, p. 727], the present record being the first of the occurrence of the disease in the field in Great Britain. In the absence of the perithecial stage the exact identity of the fungus cannot be established, but the available evidence is considered to point to *E. polygoni* as the responsible agent, rather than *E. cichoracearum*, to which the mildew has also been referred by various authorities [ibid., xiii, p. 515].

Heat canker of flax, recently reported from Co. Donegal [ibid., xx, p. 62], was observed in June, 1939, in a few crops in Co. Tyrone.

Gregory (P. H.). **Studies on Sclerotinia and Botrytis. I.**—*Trans. Brit. mycol. Soc.*, xxv, 1, pp. 26–40, 3 pl., 1 graph, 1941.

By exposing to the weather material infected with sclerotia of *Botrytis* spp., preferably on sand at the bottom of 10-in. flower pots plugged at the base with glass wool and covered with cheesecloth, apothecia were secured from *B. polyblastis* [*R.A.M.*, xviii, p. 32] in all 14 pots used; from *B. narcissicola* [ibid., xix, p. 539] in 7 out of 8; from *B. cinerea* on dicotyledonous hosts in 1 out of 11, and on monocotyledonous hosts in 2 out of 19; and from a new form of *Botrytis* on *Allium triquetrum* in one pot exposed. One pot full of leaves of Golden Spur narcissus bearing sclerotia of *B. narcissicola* gave three types of apothecia, two apothecia found proving to be the perfect stage of *B. cinerea*. Sclerotia bearing single young apothecia were then placed on moist filter paper in sterile Petri dishes, and the ejected ascospores caught on a film of plain agar on a cover-glass. Single ascospores were picked off the deposit and transferred to hanging drops of sterile agar. The production of the conidial stage established its genetic connexion with the *Sclerotinia* from which it was derived.

Field studies showed that the life-cycle of *S. polyblastis* is as follows. At the close of winter, the sclerotia produce apothecia at about the time when *Narcissus tazetta* and *N. pseudonarcissus* are in flower. The ascospores infect the perianth and may set up flower-spotting, but the leaf tissue remains as yet resistant. The fungus continues to live on withered flowers, and produces enormous numbers of conidia, which set up epidemic infection on the maturing foliage. On the leaves conidia are produced somewhat sparsely, and these probably serve to spread infection. Later the leaves produce numerous sclerotia. Two steps that should do much to prevent epidemics are (1) to remove and destroy all withered narcissus leaves in summer, and (2) to remove all flowers from the field to break the cycle between sclerotium and leaf infection.

Apothecia on aestivated sclerotia of *B. narcissicola* on narcissus leaves were demonstrated to be the perfect stage of the fungus, which is named *S. narcissicola* n.sp. [with a Latin diagnosis]. The fungus is characterized by black, smooth, globose sclerotia, 1 to 1·5 mm. in diameter. The apothecia, which arise singly from the sclerotia, are cup-, later funnel-shaped, with a flat disk, warm sepia to raw umber when mature, and up to 2·5 mm. in diameter. The raw umber stipe is 1·5 to 5 mm. or more long. The under side of the cup and the stipe are covered with minute, white to brownish scales. The asci measure 120 to 140 by 8 $\mu$, and the indistinctly biguttulate, naviculate ascospores 10 to 20 by 5 to 9 (mean 15·4 by 7·1) $\mu$.

In April, 1937, a *Botrytis* was found on *A. triquetrum* in the Isles of Scilly. In May, 1939, infected leaves bearing sclerotia were placed on sand in a pot at Newton Abbot, and on two occasions subsequently apothecia were found growing from the sclerotia. The genetic connexion between the conidia and apothecia was established when young cultures from single ascospores produced the spherical conidia over the surface of mycelium and sclerotia. The fungus, which is named *S. sphaerosperma* n.sp. [with a Latin diagnosis], is characterized by black, ovate-spheroidal sclerotia measuring 1·5 to 2·5 by 0·5 to 1 mm. The warm sepia, cup-shaped, later discoid, flat apothecia, of which one or two arise from each sclerotium, measure 1 to 1·5 mm. in diameter by 0·3 mm. thick. The isodiametric stipe is dark at the base and 1·5 to 33 mm. long. The asci measure 240 by 14 to 15 $\mu$, and the naviculate ascospores measure 17 to 26 by 8 to 12 $\mu$. The conidial stage is of the *Botrytis* type, with conidiophores measuring 160 to 700 by 7 to 20 $\mu$, rarely branched; the conidia, arranged in compact heads, usually in a single whorl, hyaline, spherical, germinating by means of one to four germ-tubes, measure (from living leaves) 20 to 28 $\mu$ in diameter.

TAYLOR (R. E.). **A wilt disease of Godetias and other ornamental plants.**—*Ann. appl. Biol.*, xxviii, 2, pp. 91–101, 1 pl., 1941.

In 1936 a pycnidial fungus was found at Cambridge on the stem of wilted *Godetia* plants and subsequently a similar disease was observed on *Centaurea moschata*, *Clarkia elegans*, and antirrhinum [*Antirrhinum majus*]. On all these, typical symptoms included browning (blackening in *Centaurea moschata*) of the stem, chiefly in the lower parts, the extension of the lesion, and stem encirclement, the plants subsequently wilting. Infection commonly centres round the nodes near soil-level, but parts some distance from the ground are occasionally attacked. Abundant pycnidia later develop on the dead shoots.

Inoculations through wounds on *Godetia* and *Clarkia elegans* stems with isolates G (isolated from pycnidia on *Godetia* in 1936), GX (from the same in 1939), Cl (from pycnidia on *C. elegans*), SS (from pycnidia on *Centaurea moschata*), and AI (from wilting shoots of antirrhinum) resulted in typical symptoms. *C. moschata* plants inoculated with these fungi showed blackening of the stem, but the progress of the disease was similar. Further inoculations of wounded stems showed that GX, SS, and AI were strongly pathogenic to antirrhinum, while G and Cl appeared unable to attack it. With scabious [*Scabiosa*] only GX and Cl became established, the effect on the plants being serious only after

a considerable time. *C. cyanus* was susceptible to SS (but not to G or AI), and *Oenothera biennis* to SS.

All five isolates were pycnidial fungi, with hyaline, cylindrical spores with rounded ends, measuring approximately 6 to 9 by 2·5 to 3·5 $\mu$, 5 to 40 per cent. being uniseptate and the remainder aseptate, though occasional biseptate spores were observed. The cultural characters of the fungi isolated were compared, and found to be closely similar when first obtained from their respective hosts. They are considered to be separate strains of a single species provisionally determined as *Diplodina passerinii* [*R.A.M.*, v, p. 165] differing slightly in cultural behaviour and pathogenicity.

McCulloch (Lucia) & Weigel (C. A.). **Gladiolus diseases and insects.** —*Fmrs' Bull. U.S. Dep. Agric.* 1860, 18 pp., 9 figs., 1941.

Popular notes are given on the symptoms and causes of a number of diseases of gladiolus in the United States, with general directions for their control, including hard rot (*Septoria gladioli*) [*R.A.M.*, xiii, p. 380], scab and leaf blight, or neck rot (*Bacterium marginatum*) [ibid., xix, p. 22], dry rot (*Sclerotinia gladioli*) [ibid., xiii, p. 581], rot due to *Penicillium gladioli* [ibid., xx, p. 364], *Fusarium* rot (*F. oxysporum* var. *gladioli*) [ibid., xix, p. 582], vascular disease or yellows due to a species of *Fusarium*, mosaic [ibid., ix, p. 628; xviii, p. 784], leaf spot (*Botrytis* [? *cinerea*: ibid., xix, p. 539]), and leaf blight (*Bact. gummisudans*) [ibid., xvi, p. 180].

The most serious of these diseases at the present time is probably the *Fusarium* vascular disease or yellows. In the field the plants turn pale or yellow. The corm shows a brown rot beginning at the basal scar, passing upwards into the core, and outwards to the leaf bases. Many plants succumb, and the corms decay in the ground. When infection is less severe, the plants may mature and produce new, apparently normal corms. The disease increases during storage, and in the spring many stored, infected corms show brown spots along the nodes, or are entirely spotted. Others may appear to be healthy, but if planted, may rot or produce sickly plants, while the new corms will probably be infected. Control consists in the elimination of diseased stock, planting in well-drained soil, and storage under dry, cold conditions. Affected fields should not be planted to gladioli for some years.

Varieties with easily injured corms are very susceptible to *P. gladioli* and should be kept at 80° to 90° F. for a week or more immediately after being dug.

Tasugi (H.) & Shino (H.). **Damping-off of seedlings of China Aster and Zinnia.**—*Ann. phytopath. Soc. Japan*, x, 2–3, pp. 278–293, 4 figs., 2 graphs, 1940. [Japanese, with English summary.]

*Pythium megalacanthum* var. *callistephi* n. var., the agent of a brown, water-soaked rot of China aster (*Callistephus chinensis*) seedlings, resulting in damping-off, differs from *P. megalacanthum* proper in the production of conidia, absence of sporangia, and oospore dimensions. It is characterized by hyaline, spherical, ordinarily terminal, rarely intercalary conidia, 23·1 to 44·4 (average 34·5) $\mu$ in diameter; terminal, hyaline, spherical oogonia, 32·4 to 50·9 (41·6) $\mu$ in diameter, usually

covered with spines, 5·6 to 8·3 by 2·8 to 4·6 $\mu$; terminal or intercalary, hyaline, reniform antheridia, 11·1 to 21·3 by 8·3 to 17·6 (15·7 by 12·6) $\mu$, generally one, rarely two, per oogonium; and spherical oospores, almost filling the oogonium, 22·2 to 39·8 (33·1) $\mu$ in diameter, with pale yellowish-brown, smooth walls, 0·9 to 2·8 $\mu$ in thickness.

Good growth is made on oatmeal and potato agars over a range from 10° to 29° C., with an optimum at 23°, the most favourable hydrogen-ion concentration lying between $P_H$ 5·8 and 6·9. Inoculation experiments on *C. chinensis*, lettuce, and *Papaver rhoeas* resulted in typical damping-off, *Zinnia elegans* being somewhat less susceptible, *Calendula officinalis* and *Antirrhinum majus* resistant, and tomatoes merely developing a brown discoloration of the roots.

A strain of *Pythium spinosum* [*R.A.M.*, xvii, p. 246], presenting certain anomalies in respect of pathogenicity and conidial dimensions, causes damping-off of *Z. elegans* and in inoculation experiments severely attacked its own host, *Callistephus chinensis*, cabbage, lettuce, *A. majus*, *Calendula officinalis*, and *Papaver rhoeas*, while cucumber, tomato, and eggplant contracted mild infection. Potato and bean agars were the most suitable media for the growth of the fungus, the minimum, optimum, and maximum temperatures for its development being 8°, 24°, and 35°, and the optimum hydrogen-ion concentration between $P_H$ 5·8 and 6·5.

ARK (P. A.) & TOMPKINS (C. M.). **The boron-deficiency disease of Gloxinia and its control.**—*Phytopathology*, xxxi, 5, pp. 467–469, 1 fig., 1941.

During the last three years, *Sinningia speciosa* growing in commercial glasshouses in the vicinity of San Francisco Bay and near Santa Cruz have been affected by a serious disease, attacking small to large seedlings in flats and transplanted seedlings in pots, and occasioning losses frequently ranging from 50 to 75 per cent. of the crop.

On young seedlings small, brownish-black, non-necrotic, irregular areas appear at or near the base of the leaf lamina. Discoloration spreads in a few days towards the tip of the leaf and down into the crown of the plant, the leaves showing conspicuous loss of turgidity. The growing point is often killed prematurely. On older, affected plants in pots, the flowers and peduncles are greatly reduced in size, and appear to be wilted; the aerial parts become necrotic, then death ensues.

No organism was associated with the condition. The plants were growing in a natural compost of forest soil, twigs, debris, and rat excrement, known as 'ratsnest', and experimental evidence showed that this medium was deficient in boron. The condition was controlled by several applications of a 6 per cent. solution of boric acid applied fortnightly.

A similar disease observed on *Calceolaria herbeo-hybrida* was also controlled by the same treatment.

BOND (T. E. T.). **A leaf spot disease of annual Phlox.**—*Trop. Agriculturist*, xcvi, 3, pp. 142–146, 1 pl., 1941.

In February, 1941, *Phlox drummondii* plants growing in Ceylon were

severely attacked by a leaf spot found to be due to a species of *Septoria* with pale brown, immersed pycnidia, 55 to 160 (mean 103·4) $\mu$ in diameter, and hyaline, filiform or acicular, straight, slightly curved, or bent spores, showing up to 3 septa, 17 to 66·5 (43·3) by 1·5 to 3 (2·1) $\mu$. The fungus is regarded as agreeing more closely with *S. drummondii* [*R.A.M.*, xix, p. 197] than with *S. phlogis* Sacc. & Speg. [ibid., xvii, p. 654] or *S. divaricatae* Ell. & Ev. (= *S. phlogis* Ell. & Ev. non Sacc. & Speg.), and the first name is provisionally adopted for it, though the distinctions between the three species may be purely hypothetical. Control is recommended by garden hygiene and (if necessary) fortnightly applications of sulphur dust or Bordeaux mixture. This is the first record for the fungus in Ceylon.

Akai (S.). **On the pathological histology of the deformed petioles and leaves of Camellia japonica caused by an undetermined species of Exobasidium.**—*Ann. phytopath. Soc. Japan*, x, 2–3, pp. 105–109, 4 figs., 1940. [Japanese, with English summary.]

In the neighbourhood of Kyoto the young foliage and sometimes the young green stems of *Camellia japonica* are attacked by *Exobasidium camelliae* [*R.A.M.*, xix, p. 413] var. *nudo*, which produces circular spots resembling those of blister blight (*E. vexans*) on tea. The cells of the affected organs undergo hypertrophy but no hyperplasia. The exogenous hymenium of the pathogen originates below the epidermal cells or in the intercellular spaces of one to three subepidermal layers, which subsequently rupture and expose the hymenium.

Ogawa (T.). **Preliminary report on the leaf spot disease of Camellias caused by Graphiothecium kusanoi sp. nov.**—*Ann. phytopath. Soc. Japan*, x, 2–3, pp. 269–277, 7 figs., 1940. [Japanese, with English summary.]

*Graphiothecium kusanoi* n.sp., which forms greenish-white, circular spots, 2 to 4 mm. in diameter, with black, 'snake eye' centres, on the upper leaf surfaces of *Camellia japonica* var. *spontanea* in the Tokyo Imperial University Forest, is described [with a Latin diagnosis] as provided with hypophyllous, erumpent stromata, with pitch-black, conical protuberances, 1 mm. in diameter and 0·5 mm. in height, whence arise persistent, simple, pitch-black synnemata (1 to 30 per stroma), 850 by 70 $\mu$, those developing from the apices of the mature ones being straight, slender, and pale-coloured; hyaline, bifurcate or penicillate conidiophores, and ovoid or ellipsoid, concatenate, hyaline conidia, 6 to 10·6 by 3·5 to 4·5 $\mu$. The pathogen gains ingress to the leaf through the stomata on the under surface, forming its stroma in the respiratory cavity. The invaded tissues decay and turn brown, while the surrounding cells undergo division.

Hidaka (Z.). **Note on a new spotted Bamboo 'Yôraku-montiku' caused by Lembosia tikusiensis n.sp.**—*Ann. phytopath. Soc. Japan*, x, 2–3, pp. 150–153, 2 pl., 1940. [Japanese summary.]

*Lembosia tikusiensis* n.sp. is the name applied to a fungus producing a very ornamental pattern, in the shape of light to dark brown, concentrically zonate, elliptical spots, 12 by 6 mm., usually between the

hird and tenth aerial nodes, on bamboo (*Phyllostachys nigra* var. *henonis*) near Hukuoka and in other regions of Japan, where they are highly prized commercially for sale as souvenirs. The culms chiefly affected are those in a state of debility through overcrowding, lack of sunshine, excessive humidity, or other adverse environmental factors. The fungus is described [with a Latin diagnosis] as characterized by a superficial, brown, branching mycelium, 2·5 to 3 $\mu$ in diameter; brown, circular or irregular hyphopodia, 14 to 26 $\mu$ in diameter; elongated, sometimes radiating, blackish-brown perithecia, 153 to 1,064 by 82 to 216 $\mu$, with linear fissures or ostioles; and ovoid or pyriform asci, 32 to 44 by 16 to 19 $\mu$, containing eight light brown, oblong to ovoid, uniseptate, smooth spores, 16 to 18 by 7 to 9 $\mu$, and accompanied by numerous filiform, hyaline paraphyses, 44 $\mu$ in length, swelling towards the apices.

SAMPSON (KATHLEEN) & WESTERN (J. H.). **Diseases of British grasses and herbage legumes.**—vii+85 pp., 8 pl., 15 figs., Cambridge University Press, 1941. 5*s*.

This fully documented and clearly illustrated monograph on the diseases of British grasses and herbage legumes (to which a foreword is contributed by Sir George Stapledon) is a most valuable contribution to phytopathological literature, embodying the results of the investigations at the Welsh Plant Breeding Station, Aberystwyth, during the past 20 years. The main purpose of the compilation is to present in an accessible form information on the fungal and other diseases of the crops originally appearing in scattered periodicals, while an attempt has also been made to assess the relative importance of the various parasites discussed in the light of regional surveys. A 13-page bibliography is appended. The monograph is issued for the authors by the British Mycological Society.

JACQUES (W. A.). **Crested Dogstail (Cynosurus cristatus), its character and behaviour under New Zealand conditions.**—*N.Z. J. Sci. Tech.*, A, xxii, 3, pp. 128–145, 2 figs., 1 graph, 1940.

Crested dogstail (*Cynosurus cristatus*) is subject to two fungal diseases in New Zealand, one an unidentified smut of rare occurrence and (at present) no economic importance, and a species of *Helminthosporium* causing the formation on the leaves, leaf sheaths, flowering stems, and glumes of dark brown, circular or elliptical spots, the centres of which subsequently turn greyish and assume a parchment-like texture. The basal stems of the older tillers of affected plants are also liable to contract infection, and the high mortality from the disease during the summer is probably attributable to this source. In May, 1939, 370 out of 920 spaced plants set out as clones a year earlier were dead, and considerably under half the survivors showed signs of vigorous recuperation. The early-flowering commercial plants were found to be the more susceptible to the *Helminthosporium* leaf spot than the late Kentish types, the incidence of which in January, 1930, amounted to 76 per cent. in the commercial lines compared with 62 in selections therefrom. In the same year, 65 per cent. of the seeds (over 600) taken at random from infected commercial plants showed the discoloured

areas produced by the fungus on the pales and glumes, but the germinability of the seed did not appear to be impaired.

MUNCIE (J. H.) & MEGEE (C. R.). **Alfalfa bacterial wilt in Michigan.**—*Circ. Bull. Mich. agric. Exp. Sta.* 171, 11 pp., 2 figs., 1939. [Received August, 1941.]

Most of the information on bacterial wilt of lucerne (*Phytomonas insidiosa*) [*Aplanobacter insidiosum*] presented in this popular bulletin has already been noticed from the original sources cited, but it may be mentioned that, under local conditions in Michigan, the Ladak variety is comparatively resistant, surviving attacks of the pathogen to which both Grimm and Hardigan succumb. Hardistan and Kaw (probably strains of Turkestan) are also superior to Grimm in respect of wilt resistance, but the seed of these varieties is not available on the market. A limited supply of Ladak seed may be obtained at a price slightly higher than that of Hardigan and Grimm.

The agent of wilt may be carried in surface drainage water and also during the cutting of the crop on the mower knife, which should be disinfected with formaldehyde (1 in 15) before use on a healthy field. Infection has been produced on greenhouse plants by removing the tops with a razor blade dipped in a bacterial suspension, the incubation period in such cases being of seven months' duration.

An elevated site should be selected for the lucerne crop, which will thus escape the surface drainage from infected fields. The spread of wilt in the field appears to be reduced by the intermixture of smooth brome grass [*Bromus inermis*] with the lucerne. Cutting for hay or close grazing should be discontinued after 1st September, owing to the risk of winter injury and consequent facilitation of ingress for the bacterium.

ROSS (A. F.). **Purification and properties of Alfalfa-mosaic virus protein.**—*Phytopathology*, xxxi, 5, pp. 394–410, 2 graphs, 1941.

The lucerne mosaic virus [*R.A.M.*, xix, pp. 370, 382, 668], isolated in the form of a nucleoprotein from Holmes's necrotic-type Turkish tobacco plants [ibid., xvii, p. 417] by differential centrifugation at 0° to 4° C. at the Rockefeller Institute for Medical Research, Princeton, New Jersey, is approximately spherical with a specific gravity of 1·48 and a sedimentation constant of $74 \times 10^{-13}$, its molecular weight being estimated at $2{\cdot}1 \times 10^{6}$ and its diameter at 16·5 $m\mu$; it is thus the smallest of the plant viruses so far analysed. The virus, which is transmissible by the pea aphid, *Macrosiphum pisi*, is rapidly inactivated at room temperature but much more stable at 4° C. It is inactivated by sodium sulphite and sodium hydrosulphite, while cysteine has a stabilizing effect on partially but not on wholly purified preparations. Toluene assists in the preservation of the virus.

When lucerne mosaic virus dissolved in 0·1 M phosphate buffer is rubbed on Early Golden Cluster bean (*Phaseolus vulgaris*) leaves, the number of lesions induced is proportional to the virus concentration over a limited range only. At concentrations below $5 \times 10^{-4}$ gm. per c.c., the number formed as a result of inoculation decreases more

rapidly than does the virus concentration in the inoculum, and at $10^{-5}$ gm. per c.c., few or no spots develop.

[A more detailed discussion of the physical properties of the lucerne mosaic virus by M. A. Lauffer and A. F. Ross appears in *J. Amer. chem. Soc.*, lxii, pp. 3296–3300, 4 graphs, 1940.]

Ross (A. F.). **The concentration of Alfalfa-mosaic virus in Tobacco plants at different periods of time after inoculation.**—*Phytopathology*, xxxi, 5, pp. 410–420, 2 graphs, 1941.

In young necrotic-type Turkish tobacco plants inoculated with the lucerne mosaic virus [see preceding abstract], the virus content of the host increases from about the fourth to the twelfth day after inoculation, when a rapid decrease sets in, the juice from plants infected for 48 days or longer being in some cases less than 1 per cent. as active as that from plants infected for only 12 days. Even in the faintly mottled upper leaves of older plants, where most of the virus is concentrated, the strength is much less than that attained 12 days after infection. It would appear that tobacco plants inoculated with the lucerne mosaic virus recover in a similar manner to those infected by the ring spot virus [*R.A.M.*, xv, p. 751], though the former virus differs from the latter in being unstable *in vivo*.

The addition of 3 per cent. dipotassium phosphate to ground diseased tobacco plants before expressing the juice more than doubles the quantity of virus extracted. With such juice, dilution at first results in an increased number of lesions on bean leaves, probably due to an inhibitor in the juice. At medium dilutions, the number of lesions produced is inversely proportional to the dilution, but at higher ones as with the purified virus, the reductions in the number of spots are much greater than would correspond to the changes in dilution.

Wormald (H.). **Presidential address. Recent research on diseases of fruit trees and bushes in Britain.**—*Trans. Brit. mycol. Soc.*, xxv, 1, pp. 4–25, 1941.

In his presidential address to the British Mycological Society for 1940 the author reviews in some detail the progress in research on fruit diseases in Britain during the last 30 years.

Smock (R. M.). **Studies with bitter pit of the Apple.**—*Proc. Amer. Soc. hort. Sci.*, xxxviii, p. 7, 1941.

Nitrogen applications made during the growing season to apple trees at a low level of nitrogen nutrition were found to increase susceptibility to bitter pit [*R.A.M.*, xx, p. 104]. Ringing of the limbs after blossoming also increased susceptibility, and both treatments raised the osmotic concentration of the leaves more than that of the fruits. Susceptibility was, however, much reduced by the defoliation of single limbs, which ended leaf-fruit competition for water. Partial pedicel girdling increased susceptibility, increasing the osmotic concentration of the leaves at the expense of fruits. Drastic thinning increased susceptibility, increasing leaf more than fruit osmotic values. Shading of single limbs increased susceptibility. The view is expressed that bitter pit susceptibility is increased by any field or tree treatment that raises

leaf osmotic values at the expense of fruit osmotic values.

Delayed storage hastened the development of bitter pit in stored apples. Storage in controlled atmospheres delayed the onset of bitter pit, but did not reduce the final amount. Waxing the fruit before storage significantly delayed the appearance of bitter pit. High relative humidities in storage materially delayed or checked attack on highly susceptible fruit.

LATIMER (L. P.). **Relation of weather to prevalence of internal cork in Apples.**—*Proc. Amer. Soc. hort. Sci.*, xxxviii, pp. 63–69, 6 graphs, 1941.

Observations [which are tabulated] on the effect of weather conditions on the occurrence and prevalence of internal cork of apples [*R.A.M.*, xx, p. 369] in susceptible areas of New Hampshire demonstrated that climatic factors other than spring and summer rainfall have exercised slight if any influence on the prevalence or severity of the condition since 1926. Extended drought in June and July appears to be the one contributing atmospheric factor definitely responsible for the inability of the tree to obtain sufficient boron for perfect fruit development. Where boron deficiency has been reported it appears that the soil can supply boron in adequate amounts only in years of normal or excessive summer rain. The deficiency is readily overcome by applying borax or boric acid, with the result that internal cork is prevented even in dry summers. While drought in June and July appears to be essential for the development of the condition locally, its effect is even more marked when drought continues from the earlier spring months.

PICKETT (W. F.) & BIRKELAND (C. J.). **Common spray materials alter the internal structure of Apple leaves.**—*Proc. Amer. Soc. hort. Sci.*, xxxviii, pp. 158–162, 3 figs., 1941.

In a study of the effect of spray materials on the internal structure of apple leaves carried out in Kansas, 11 two-year-old trees of each of the Wealthy and York varieties in a greenhouse were sprayed after the new leaves began to appear at weekly intervals for nine weeks with a spray composed of 2½ gals. lime-sulphur (33° Beaumé) and 4 lb. lead arsenate in 100 gals., 11 trees of each variety being left unsprayed as controls. In a corresponding field experiment, 5 two-year-old York and Jonathan and 3 two-year-old Wealthy trees were sprayed from 4th May, 1940, at weekly intervals, and a similar number left as controls. The first six applications were the same as those made in the greenhouse test, the next three were of lead arsenate alone (4 lb. per 100 gals.), and the last five consisted of lead arsenate plus 2 per cent. summer oil emulsion. After the final spray in each experiment, representative leaves were collected and prepared for microscopic study, the ratio, R, of the area of the internally exposed surface to that of the externally exposed surface being calculated for each leaf collected by using Turrell's formula (*Amer. J. Bot.*, xxiii, pp. 255–264, 1936).

In the greenhouse test, the R values for the unsprayed and sprayed Wealthy leaves were 13·4 and 10·71, respectively, the corresponding figures for York being 9·44 and 6·88. In the field test the R values

for the unsprayed Wealthy, Jonathan, and York leaves were 15·3, 13·54, and 11·63, respectively, and for the sprayed ones 11·96, 10·26, and 7·71.

It is concluded that the R ratio in greenhouse- and field-grown apples is reduced by repeated applications of certain spray materials; the evidence also indicated that some of the reduction in photosynthetic activity resulting from spraying may be due to the changes induced in the internal structure of the leaves.

Osterwalder (A.). **Lagerschorfähnliche Flecken am Glockenapfel.** [Storage scab-like spots on the Glocken Apple.]—*Schweiz. Z. Obst- u. Weinb.*, l, 11, pp. 252–254, 1 fig., 1941.

*Gloeosporium album* was isolated in pure culture on gelatine with a little pear juice from black, irregularly lobate spots, 1 to 1·5 by 1 to 1·5 mm. on stored Glocken apples [*R.A.M.*, xix, pp. 226, 479, 690] at Wädenswil, Switzerland. The lesions closely simulated those of scab [*Venturia inaequalis*], except that towards the centre they were smooth instead of rough, felty, or flocculent. Further, the rind and flesh underlying the *G. album* lesions were discoloured for a depth of about 1 mm., whereas the tissues beneath the scab spots were white. Inoculation experiments with *G. album* were successful only through wounds.

Stoll (K.). **Untersuchungen über den Apfelmehltau (Podosphaera leucotricha [Ell. u. Ev.] Salm.).** [Studies on Apple mildew (*Podosphaera leucotricha* [Ell. & Ev.] Salm.).]—*Forschungsdienst*, xi, 1, pp. 59–70, 1 fig., 4 graphs, 1941.

Apple mildew (*Podosphaera leucotricha*) is stated to be prevalent every year in the Rhine Province, Hesse-Nassau, the Saxon Free State, Westphalia, and the Saar Palatinate, infection reaching a climax during the spring and early summer, except in young plantings of growing trees, in which severe attacks may be expected right up to the autumn. Besides apples, *Malus* [*Pyrus*] *baccata*, *M.* [*P.*] *coronaria*, *M.* [*P.*] *ringo* [*R.A.M.*, xviii, p. 507], *M.* [*P.*] *pumila*, pear [ibid., xii, p. 747], and quince [ibid., xviii, p. 295] serve as hosts of the fungus. In this connexion attention is drawn to the discrepancies between statements regarding varietal reaction to apple mildew from different localities, the Ontario variety, for instance, being designated in 42 per cent. of the reports from fruit-growing regions as resistant, in 25 per cent. as moderately susceptible, and in 33 per cent. as highly susceptible (equally so with Landsberg Reinette). It is apparent from such conflicting evidence that very slight differences of habitat, notably those connected with physiographic factors, e.g., exposure and altitude, play an important part in the course of infection [cf. ibid., xii, p. 298].

Studies on the germination of the conidia of *P. leucotricha* designed to amplify the results obtained by Hammarlund in Sweden [ibid., iv, p. 431], Woodward in England [ibid., vi, p. 732], and Berwith in the United States [ibid., xvi, p. 262], were carried out on collodion membranes, the use of which doubled the germination percentage as compared with glass (approximately 20 and 10 per cent., respectively), while a further stimulus was lent to the process by the impregnation

of the membranes with ether, acetone ethyl acetate, ether ethyl acetate, or ethyl acetate alone, the last-named being particularly effective (50 per cent. germination). The optimum temperature for conidial germination was found to lie between 19° and 25° C.; at greenhouse temperatures viability is rapidly lost, but round about 0° it may be maintained for several weeks. Using Janisch's method (*Handb. biol. Arbeitsmeth., Berlin*, v, 10, pp. 87–112, 1933), the writer determined the effect of the gas or vapour layer over the leaf surface on infection, the test plants being exposed to an air current of a velocity of 4 mm. per second, while the controls were maintained in a still atmosphere. In moving air infection took place only at saturation point, conidial germination being inhibited by a 7 per cent. deficit of relative humidity, whereas the leaves in a still atmosphere contracted the disease at relative humidities down to 34 per cent. Artificial field infection is best carried out in the evening or in cloudy weather on shoots protected by parchment bags.

Theoretically it should be possible to group apple varieties in two classes in respect of their reaction to mildew, those capable of withstanding infection of the non-woody axillary organs [axillary buds] being deemed resistant and those lacking this character susceptible. In practice, however, it is necessary to introduce three grades of intermediate reaction, so that five classes had to be established to accommodate the 10,000 one-year-old plants inspected at the Biological Institute, Dahlem, Berlin, in 1938. Among the highly resistant varieties placed in class 1 were the Doucin stocks, which are of particularly vigorous habit, while all clones succumbing to the disease under the favourable conditions (for the host) afforded by the locality may in general be regarded as definitely susceptible and relegated to class 5. The intermediate classes were occupied by varieties showing a propensity to 'pseudo-resistance' or 'escape' characterized by rapid passage through the critical juvenile stage for foliar infection and no doubt largely dependent on nutritional factors [*R.A.M.*, xii, p. 517].

HALLER (M. H.) & LUTZ (J. M.). **A comparative study of storage at 32° and 36° F. of Apples grown in the Potomac River Valley.**— *Tech. Bull. U.S. Dep. Agric.* 776, 41 pp., 2 graphs, 1941.

This is a comprehensive, tabulated survey of the effects on 13 commercial apple varieties from the Washington, D.C., district of storage at 32° and 36° F. at the Arlington (Virginia) Experiment Farm in 1935, 1936, and 1937 (Jonathan also in 1934).

Among 49 comparable lots of the different varieties at each temperature (20 from 1935, 22 from 1936, and 7 from 1937) showing a minimum of 5 per cent. decay, the average incidence, attributable mainly to black rot (*Sphaeropsis malorum*) [*Physalospora obtusa*] and blue mould (*Penicillium expansum*), but associated in some instances with *Sporotrichum malorum*, *Botrytis* sp., and *Glomerella cingulata*, was 13·6 per cent. at 32° and 19·8 at 36°. The average percentage of rot for all lots was uniformly higher at 36° than at 32°.

Scald tended to appear earlier in fruit stored at 36°, but eventually became equally or more severe in the lots kept at the lower temperature. The average incidence of the trouble in 18 lots examined at the time of removal from storage was 12·5 per cent. at 32° and 21·1 at 36°,

whereas in 43 inspected a week after keeping at 70°, the corresponding figures for the two temperatures were 35·4 and 31·2 per cent., respectively.

Internal breakdown was more prevalent in Arkansas and Stayman Winesap at 36° than at 32°, but the other varieties included in the tests showed no consistent differences in this respect. Bitter pit was severe in Yellow Newtowns at 36°.

On the basis of these data and those obtained by other workers, the proposal of Plagge *et al.* [*R.A.M.*, ix, p. 39; xiv, p. 592] to change the standard temperature of storage, as recommended by the United States Department of Agriculture [ibid., vi, p. 492], from 32° to 35° or 36° cannot be endorsed.

**Apple sooty-blotch and fly speck.**—*Indian Fmg*, i, 9, pp. 440–441, 1940.

Good control of sooty blotch [unspecified] and fly speck [? *Leptothyrium pomi*] of apples has been obtained at the Government Fruit Station, Chaubattia, United Provinces, by four applications of 1 in 40 lime-sulphur, 32° Beaumé, sp. gr. 1·283, (1) and (2) at the open-cluster and petal fall stages, respectively, (3) at fruit formation, and (4) when the fruits reach maturity. Thinning the fruits so as to leave two apples per cu. ft. of tree space also assists in the reduction of infection. A simpler method of disinfection consists in one minute's immersion of the picked fruits either in 5 per cent. bleaching powder or 3 per cent. sodium chlorate, followed by ten minutes' exposure to the air, washing in tap water, and wiping with a cloth to remove the disfiguring blemishes.

KAWAMURA (E.). **Studies on Gymnosporangium haraeanum Syd. I. Heterothallism in the fungus.**—*Ann. phytopath. Soc. Japan*, x, 2–3, pp. 84–92, 3 figs., 1940. [Japanese, with English summary.]

In the later stages of the Japanese pear [*Pyrus serotina*] rust caused by *Gymnosporangium haraeanum*, the alternate hosts of which in Japan are *Juniperus chinensis* and its var. *procumbens* [*R.A.M.*, xvi, p. 411], natural infections completely devoid of aecidia have been not infrequently observed. A study of the sexual behaviour of the fungus designed to elucidate this phenomenon was initiated by the sparse sowing of sporidia on pear leaves. Each infection gave rise to spermogonia, from which spermatia-containing nectar was exuded. At the end of 11 weeks, most of the infections left in an isolated condition remained sterile, whereas aecidia developed within 16 days from the majority of those fertilized by spermatia from the other infections, aecidiospores subsequently appearing in due course. Natural mixtures of nectar in coalescent infections for the most part produced aecidia, which did not arise, on the other hand, from spermogonial nectar denuded of the spermatia by filtration. The spermatia of the rust thus serve to provide the mycelium of monosporidial infections with the opposite sex element, denoting the existence of heterothallism *sensu lato*.

BOYNTON (D.), REUTHER (W.), & CAIN (J. C.). **Leaf analysis and apparent response to potassium in some Prune and Apple orchards. Preliminary report.**—*Proc. Amer. Soc. hort. Sci.*, xxxviii, pp. 17–20, 2 figs., 1941.

During studies on the potassium level of fruit trees growing on some

important New York orchard soils, instances of leaf scorch were noted which were associated with a very low potassium content of the foliage.

On affected Italian prunes the leaves appeared normal in spring and early summer. By the middle of July, the leaves on some peripheral branches began to lose their normal green colour, generally fading at the margins first. As the chlorosis progressed, the margins of the older shoot leaves rolled inwards towards the upper surface. Lastly, marginal necrosis developed. On trees severely affected nearly all the leaves sometimes showed a progressive development of these symptoms, while on those moderately attacked, only the older leaves on peripheral branches developed all stages of the symptoms. Where the condition was slight, the symptoms developed late, on outer branches only, and in some cases did not develop beyond the leaf roll stage. The cumulative effects of severe scorch on Italian prunes were reduced terminal growth, retarded fruiting of young trees, and conspicuous dwarfing. In an orchard on apparently uniform soil there were sometimes marked differences in degree of scorching between the trees.

On apples the general symptoms were the same. The leaves of Rhode Island Greening, however, tended to fold at the midrib towards the upper surface rather than to roll. McIntosh leaves did not fold or roll until severe marginal necrosis had developed, while the midribs of affected McIntosh leaves appeared more reflexed than is normally the case.

Tests of response of affected trees to potassium fertilization resulted in the complete disappearance of symptoms on one group of trees which received a heavy mulch of manure in 1939 and 3 lb. potassium fertilizer annually and a reduction in other cases; the partial failure may be due to a lag in the effectiveness of the potash.

Zeller (S. M.) & Evans (A. W.). **Vein clearing, a transmissible disease of Prunus.**—*Phytopathology*, xxxi, 5, pp. 463–467, 1 pl., 1941.

Sweet cherries of the Bing, Black Republican, and Lambert varieties, Italian prunes, and *Prunus serrulata* in Oregon were observed in 1936 to be affected by a new virus disease termed vein-clearing, specimens of which on *Prunus* [unspecified] were also received from one district of Washington.

The first symptoms appear on the leaves, the veins of which are uniformly or partially cleared and the margins usually markedly indented. Enations in the form of small, blistered proliferations along the under side of the main veins sometimes develop in the early part of the season. By reflected light a characteristic silvering of the upper leaf surfaces is apparent. At midsummer the affected trees present a somewhat wilted aspect. Shortness of the internodes and a prolific output of buds, spurs, or short branches at the nodes induce a tendency to rosetting, especially at the end of the year-old wood. The fruits of diseased trees may be pointed, flattened on the suture side, and ridged along the suture, but such malformations are practically absent on Black Republican; in the Lambert variety persistent infection involves virtual loss of the fruit crop. Vein-clearing has been shown by preliminary experiments to be graft-transmissible and graft-perpetuated, the incubation period of the virus on Lamberts being about four

months. No insect vector of the disease has been detected, but there are definite indications of natural infection and spread in orchards and nurseries.

The symptoms of vein-clearing are briefly compared with those of mottle leaf [*R.A.M.*, xvi, p. 518], an instance of the apparent predominance of the former over the latter in double infection on a Bing cherry being reported.

The numbers assigned to mottle leaf and vein-clearing are *Prunus* virus 7 and *Prunus* virus 8, respectively [ibid., xvii, p. 52], or following Holmes's classification [ibid., xx, p. 85], the names *Marmor cerasi* and *M. nerviclarens*, respectively.

HOAGLAND (D. R.). **Water culture experiments on molybdenum and copper deficiencies of fruit trees.**—*Proc. Amer. Soc. hort. Sci.*, xxxviii, pp. 8–12, 3 figs., 1941.

When myrobolan [*Prunus divaricata*] seedlings were grown in nutrient solutions deficient in copper, but containing amounts of it varying from 0 to 0·1 parts per million, deficiency symptoms appeared in all the cultures except in the one containing the greatest amount of the metal. The chief symptom was the dying of the twigs from the tip, this effect resembling, apparently, that described by Oserkowsky and Thomas for pear exanthema in the field [*R.A.M.*, xviii, p. 119]. During the early stages of growth some of the copper-deficient leaves showed a slight purple tint; they turned pale later, but developed no extreme chlorosis. In further tests, the foliage colour was good when 0·2 parts per million of copper were added, but 0·05 parts per million did not give healthy plants. The view taken by Oserkowsky and Thomas, that the exanthema disease studied by them was due to copper deficiency, is supported by these results.

When myrobolan seedlings were grown in nutrient solutions without molybdenum, only one plant of 15 failed to show nutrient deficiency. In the remainder, the leaves were dwarfed, some showed a diffuse mottling, and many developed light brown areas of dead tissue at the tips and margins.

DICKEY (R. D.) & BLACKMON (G. H.). **A preliminary report on little-leaf of the Peach in Florida—a zinc deficiency.**—*Bull. Fla agric. Exp. Sta.* 344, 19 pp., 8 figs., 1940.

In a 20-acre commercial orchard of Jewel peaches on Norfolk pine sandy soil in Pasco County, Florida, little leaf [*R.A.M.*, xx, p. 214] was effectively combated by the application to the soil of $\frac{1}{2}$, 2, or 5 lb. zinc sulphate per tree, no additional benefit being derived from the addition of magnesium or manganese sulphate, both of which compounds were likewise useless alone. Equally satisfactory results followed the treatment of the foliage with a zinc sulphate-lime spray (5–2$\frac{1}{2}$–100), using 1 lb. calcium caseinate as a sticker for the lime, and here again the incorporation of manganese with the zinc, or its independent application, failed to induce any response. In addition to the Jewel variety, Waldo, Angel, and Luttichau peaches also suffer from little leaf, which has been observed over extensive areas of the State.

Cation (D.). **Peach diseases.** ***ex*** **Peach culture in Michigan.**—*Circ. Bull. Mich. agric. Exp. Sta.* 177, pp. 69–85, 2 col. pl., 16 figs., 1941.

The writer gives clear descriptions of the symptoms and directions for the control of the fungal, bacterial, and virus diseases of peaches in Michigan, the last-named group including yellows, little peach [see preceding abstract] (both illustrated by excellent coloured plates), red suture [*R.A.M.*, xvi, p. 109], and rosette mosaic [ibid., xx, p. 371].

Evans (A. W.) & Owens (C. E.). **Incidence of Sclerotinia fructicola and S. laxa on Sweet Cherries in Oregon.**—*Phytopathology*, xxxi, 5, pp. 469–471, 1941.

*Sclerotinia fructicola* was isolated 56 times from blighted sweet cherry blossoms and 39 times from rotted fruits at the Oregon Agricultural Experiment Station in 1940 (72·72 and 51·32 per cent., respectively), the corresponding figures for *S. laxa* being only 21 and 37 (27·28 and 48·68 per cent., respectively). These data are at variance with those reported by Barss in 1923 (*Circ. Ore. agric. Exp. Sta.* 53) and from California in 1939 by Hewitt and Leach [*R.A.M.*, xviii, p. 533], who found *S. laxa* more widespread on stone fruits than *S. fructicola*.

Bhargava (K. S.). **Pythium aphanidermatum (Edson) Fitz. on Carica papaya.**—*Curr. Sci.*, x, 4, pp. 212–213, 1941.

During the rainy season of 1940, papaw trees at Naini, Allahabad, were attacked by an epidemic of stem and foot rot due to *Pythium aphanidermatum* [cf. *R.A.M.*, xviii, p. 781]. Inoculations with the fungus from diseased stems on healthy papaw trees were partly successful, but the patches caused by infection healed up in winter. Inoculations in November and December failed to reproduce the disease, probably owing to the prevailing cool, dry weather.

**Department of Agriculture, Mauritius, Proclamation No. 26 of 1941. To prohibit the importation into Mauritius of certain plants.**—1 p., 1941. [Mimeographed.]

No living parts, except seeds, of cassava or plants belonging to the genus *Jatropha* may be imported into Mauritius from any country or place (including the Dependencies of Mauritius) without a duly authenticated certificate vouching for the origin of such plants or parts thereof in a district free from cassava mosaic.

The importation into Mauritius from the Union of South Africa of any parts of the *Dahlia* plant, except seeds, is absolutely prohibited [? against tomato spotted wilt: *R.A.M.*, xviii, p. 112].

**Bermuda Bye-Laws. Amendment of Bye-Laws made by the Board of Agriculture on 7th March, 1939, regulating the control of plant diseases and pests.**—1 p., 1941.

The importation into Bermuda of all parts of *Musa* spp. (bananas and plantains, etc.), including the fruit, is prohibited by an Order of the Board of Agriculture dated 10th June and approved by the Governor in Council 9th July, 1941 [*R.A.M.*, xviii, p. 704].

IMPERIAL MYCOLOGICAL INSTITUTE

# REVIEW OF APPLIED MYCOLOGY

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HARTMANN (H. T.). **Tests with new copper fungicides with special reference to injury, tenacity to foliage, and dwarfing effect.**—*Proc. Amer. Soc. hort. Sci.*, xxxviii, pp. 148–152, 1941.

Comparative tests were made in 1939 and 1940 at the Missouri Agricultural Experiment Station on apple and cherry trees with various new proprietary copper-containing sprays, Bordeaux mixture, and lime-sulphur to obtain information as to the toxicity of these materials to fruit and foliage, the degree of control obtained against cherry leaf spot (*Coccomyces hiemalis*), and their effects on the size of cherry fruits on treated trees. The results [which are tabulated] showed that Bordeaux mixture (6–8–100) exercised a dwarfing effect on the fruit and foliage of sour cherries, and when used early in the season on apples caused foliage-burning and fruit-russeting. Bordeaux mixture, cupro K (copper oxychloride: Röhm and Haas Co.), yellow cuprocide (yellow cuprous oxide: Röhm and Haas Co.), and spray cop (basic copper sulphate: General Chemical Co.) gave satisfactory control of *C. hiemalis* [*R.A.M.*, xx, p. 170]. Bordeaux mixture and copper phosphate showed the largest initial deposit of copper on the leaves and had the best adhesive qualities of the materials tested. Two materials offered promise as substitutes for Bordeaux mixture in their control of *C. hiemalis* and innocuousness to the trees, viz., cupro K (3–100) and spray cop (1½–100).

REEVES (E. L.). **Mottle leaf, a virus disease of Cherries.**—*J. agric. Res.*, lxii, 9, pp. 555–572, 8 figs., 1941.

Mottle leaf of cherries [*R.A.M.*, xv, p. 664; cf. xix, p. 416], stated to be a virus disease transmissible only by grafting and similar processes, is reported from Washington, Oregon, Idaho, California, and British Columbia attacking, as far as is known, only four commercial varieties (Bing, Napoleon, Waterhouse, and Lambert) in the field. The disease is believed to have been present in the Pacific Northwest for more than 20 years. The symptoms of the disease vary considerably in different varieties and even in different trees of the same variety. Diseased trees exhibit puckered, misshapen, and mottled leaves, eventually become stunted, and produce no marketable crop after three or more years. Some of the chlorotic spots on the leaves drop out but there is no premature defoliation. Of the 19 cherry varieties inoculated none was immune from mottle leaf, although many were quite tolerant.

Attempts to transmit the disease to other stone fruits by budding were mostly unsuccessful (with the exception of one transmission from cherry to peach in the greenhouse) owing to failure to achieve growth union. The disease was transmitted from cherry to cherry by budding, symptoms appearing after 14 days in the greenhouse and 37 in the field. Attempted transmission by mechanical means or through *Myzus cerasi* was unsuccessful, and the manner of spread of the virus remains unknown. Hot water treatment of bud sticks at 46° C. for 60 minutes and at 49° for ten failed to inactivate the virus. Since no tree showing definite leaf symptoms is known to have recovered, the removal of diseased trees from the orchard is recommended as a measure of controlling the spread of the disease.

Reid (R. D.). **Red core disease of the Strawberry.**—*Scot. J. Agric.*, xxiii, 3, pp. 264–272, 1941.

After stating that strawberry red core disease (*Phytophthora fragariae*) [*R.A.M.*, xix, p. 608] is now known to occur in 18 counties in Scotland (in some of which only a few outbreaks have been recorded), in 5 counties in England, and in 11 States of the American Union, the author gives details of research work on control carried out since 1929 by the Department of Agriculture for Scotland in association with the West of Scotland Agricultural College. Three lines of investigation have been followed, viz., cultural improvement, chemical treatment, and selection and breeding for resistance.

With regard to the first, improvement in the standard of cultivation may be desirable in many cases, but it would be quite erroneous to think that cultural improvement in itself will eliminate the disease [cf. ibid., vii, p. 384]. Chemical methods have so far given disappointing results. Breeding work has resulted in the release to growers of five seedling varieties (notes on the fruiting characters of which are given), viz., Auchincruive, 1, 2, 4, 5, and 6 [ibid., xx, p. 215]. During the first five years' tests no infection was shown by any of these, but in the last three years occasional plants have shown slight infection. Damage is often associated with highly unfavourable soil conditions, and is accompanied or preceded by the presence of weak parasites. The total proportion of plants affected has been small, but the possibility that resistance may decline cannot be disregarded, and in a footnote the author states that evidence is to hand indicating that in certain cases breakdown of resistance may be more serious than was anticipated.

Under practical field conditions, however, the resistance shown by these varieties in contrast with ordinary commercial varieties is striking. They have been tested widely throughout western Scotland, and generally appear to be virtually immune. Tests with four of these varieties in Illinois showed them to be completely resistant under American conditions. Similar results were obtained in Maryland. C. J. Hickman in tests made in Kent under very severe conditions found three of the varieties to be entirely resistant, and a fourth very nearly so. All these varieties, however, are very susceptible to yellow edge and crinkle [ibid., xix, p. 716]. Large-scale tests also demonstrated that the variety known in America as Aberdeen is also resistant to red

core in Scotland; this has now been released under the name of American Aberdeen.

IYRIBOZ (N.). **Incir hastaliklari.** [Fig pests.]—*Publ. Minist. Agric. Turk. Rep.* 489, 88 pp., 33 figs., 1940.

Included in this annotated list of fig pests and diseases are six pages dealing with 15 pathogens of the crop in Turkey and elsewhere.

**Nueva maquina para el combate de la Sigatoka.** [A new machine for the control of 'Sigatoka'.]—*Rev. agríc., Guatemala*, xviii, 1, pp. 25–27, 4 figs., 1941.

A new portable spraying apparatus for the treatment of 'Sigatoka' disease of bananas [*Cercospora musae*] has recently been devised by the proprietors of a plantation in San Felipe, Retalhuleu, Guatemala [*R.A.M.*, xix, p. 551]. The machine is provided with a 3 h.p. motor, a wooden tank of 100 gals. capacity, and two rubber hoses 50 ft. long and 1 in. in diameter, each capable of discharging from its nozzle 3 gals. 5–5–50 Bordeaux mixture per minute at a pressure of 300 lb. per sq. in. The machine covers an acre per hour and the cost of the treatment, allowing for two applications a month during the growing period, is estimated at 0·07 quetzals [1 quetzal=about 4*s*. 1*d*. at par] per rhizome.

STEVENS (H. E.) & PIPER (R. B.). **Avocado diseases in Florida.**—*Circ. U.S. Dep. Agric.* 582, 46 pp., 15 pl., 1 graph, 1941.

This is an important, very well-illustrated contribution to the knowledge of the symptomatology, etiology, mode of infection, and control of avocado diseases in Florida, where the acreage under the crop is stated to be expanding and interest in it increasing.

Scab (*Sphaceloma perseae*) [*R.A.M.*, xvii, p. 760; xix, p. 366] is widespread and severe, causing up to 100 per cent. fruit infection on susceptible varieties of West Indian, Guatemalan, and West Indian-Guatemalan hybrid extraction, such as Lula; Pollock, Collinson, Waldin, Collins, and Gottfried, on the other hand, are highly resistant. As a result of six years' experiments in the control of the disease in a commercial grove at Lake Placid, the following schedule (subject to modifications to suit the conditions of a particular season) has been evolved and should prove generally effective: 3–3–50 Bordeaux mixture (1) dormant, just before or immediately after flower bud appearance; (2) near the end of the blossom, when small fruits are visible; (3) two to four weeks after (2); (4) three to four weeks after (3); (5) a month after (4), the two last being necessary only in wet seasons.

*Cercospora purpurea* is probably responsible for heavier damage to the crop than any other single disease, being practically ubiquitous on the leaves, fruit stems, and fruits of the Fuerte, Waldin, Winslowson, Trapp, Lula, Wagner, Taylor, Nobal, Pollock, Eagle Rock, and West Indian seedlings. On the leaves the fungus produces purplish, later brown, first raised, then sunken, scattered or coalescent spots, those on the fruits commencing as greenish-white dots and expanding into slightly sunken, irregular, brown to dark brown blotches, $\frac{1}{8}$ to $\frac{1}{4}$ in. in diameter, often merging into areas of dead rind tissue deeply fissured by surface cracks. Infected leaves are the principal source of perpetuation of *C. purpurea*, the perfect stage of which, occasionally found in

large, necrotic lesions on mature foliage, appears to be a *Mycosphaerella*. Inoculations with the latter have resulted in the development of typical fruit-spotting, but natural infection is attributable mainly to the *Cercospora* conidia, which are formed in profusion during warm, rainy weather, and distributed over long distances by wind and insects, and through the individual trees in drops of rain or heavy dew. The critical period for attacks on the fruit is between mid-May and late August, when it is a quarter to three-quarters mature, corresponding to the time of maximum spore production. After the fungus has entered the rind, an incubation period of 30 to 40 days elapses before the appearance of any external symptoms, and another 10 to 15 days until spore formation. The following schedule is recommended for the joint control of *C. purpurea* and the causal organism of black spot or anthracnose (*Colletotrichum gloeosporioides*) [ibid., xix, p. 135; xx, p. 268]: 4–4–50 Bordeaux mixture (1) between 1st and 15th May, care being taken to ensure full coverage of the leaves and fruits; (2) not later than a month after (1); (3) a month after (2), this treatment being required only on varieties not maturing until the winter or early spring.

Stem-end rots of minor economic importance are caused by *Diplodia natalensis* [ibid., xii, p. 707], a *Phomopsis* distinct from *P.* [*Diaporthe*] *citri*, and a *Dothiorella* apparently different from that responsible for a serious decay of the avocado crop in California [namely, from *D. gregaria*, the imperfect stage of *Botryosphaeria ribis* var. *chromogena*: ibid., xv, p. 238].

Collar rot is due to a *Phytophthora* of the *P. parasitica* group [ibid., xiv, p. 707], while other diseases of a relatively innocuous character include powdery mildew (*Oidium* sp.), rusty blight (*Gloeosporium* sp.) [ibid., iv, p. 653], fruit-russeting, possibly caused by a *Phomopsis* allied to *Diaporthe citri*, algal leaf spot (*Cephaleuros virescens*) [*C. mycoidea*: ibid., xix, p. 135], tipburn of the leaves, sun scald, and sun blotch [ibid., xviii, p. 694].

CHRISTOPHER (E. P.). **The Bordeaux formula in horticultural research.**—*Proc. Amer. Soc. hort. Sci.*, xxxviii, pp. 153–156, 1941.

Lack of uniform agreement among horticultural workers as to the precise meaning of any given formula for Bordeaux mixture induced the author to send out a questionnaire to workers in 40 different institutions in the United States and Canada to ascertain what they understood by the formula 'Bordeaux mixture 4–4–50'. At least 73 replies were received to most of the questions. The striking differences noted in the answers to any one question indicated a glaring source of error in experimental results obtained from the use of Bordeaux mixture, and it is concluded that a uniform interpretation of the formula for Bordeaux mixture is highly desirable. All results involving the use of the mixture should include a definite statement on formula interpretation and mixing methods.

ABRAHAM (E. P.), CHAIN (E.), FLETCHER (C. M.), GARDNER (A. D.), HEATLEY (N. G.), JENNINGS (M. A.), & FLOREY (H. W.). **Further observations on penicillin.**—*Lancet*, ccxli, 6155, pp. 117–189, 2 figs., 2 diags., 4 graphs, 1941.

This paper gives a detailed, well-documented review of the authors'

work at the Sir William Dunn School of Pathology and Radcliffe Infirmary, Oxford, on the large-scale production, assay, activity, and therapeutic trials on human subjects of penicillin, a bacteriostatic principle produced by *Penicillium notatum*. Penicillin exerts a selective action on certain Gram-positive bacteria, one to two parts per million inhibiting the growth of *Streptococcus pyogenes*. It is unaffected by pus, serum, or protein autolysates and is without toxic effect on leucocytes or delicate living tissues. [This work is also summarized and discussed in an editorial article on pp. 191–192.]

RADTCHENKO (S. I.). Новая методика выращивания растений при разной температуре почвы и воздуха. [A new technique of growing plants under different temperatures of air and soil.]—*Acta Inst. bot. Acad. Sci. U.R.S.S.*, Ser. IV, Bot. Exp., v, pp. 55–71, 13 figs., 1941. [English summary.]

A detailed description is given of a technique for growing plants under controlled conditions of air and soil temperature.

RUSSELL (E. J.). **The function of applied biology in war time.**—*Ann. appl. Biol.*, xxviii, 2, pp. 170–174, 1941.

In a discussion at a meeting of the Association of Applied Biologists held on 6th December, 1940, the author, in the opening speech, reviewed the problems to which biology contributes in war-time, discussing in some detail the protection of food and material against deterioration, and activities aiming at increasing the food supply.

LENTZ (P.). **Molds found in Indianapolis markets.**—*Bot. Stud. Butler Univ.*, v, Paper 4, pp. 58–66, 1941.

Among the 21 genera of moulds isolated from fruits and vegetables obtained from Indianapolis (Indiana) markets from 15th September to 15th December, 1939, *Penicillium*, *Rhizopus*, *Aspergillus*, and *Alternaria* predominated, followed by *Oospora*, *Fusarium*, *Monilia*, *Monosporium*, and *Isaria*. It was not feasible to make any very definite correlation between the fungi and the different types of hosts, but *Alternaria* and *Fusarium* seemed to prevail on hosts growing in or near the soil; *Aspergillus* and *Monilia* on ordinary orchard fruits; while *Penicillium* was the only genus found on citrus fruits [cf. *R.A.M.*, xvi, p. 558]. Grapes yielded a species of *Melanconium*, the occurrence of which in Indiana constitutes a departure from its normal range. *Mucor* was isolated only once, from carrots. Species of the following genera, not hitherto identified in association with uncooked fruits and vegetables in the Butler laboratories, were isolated in the course of these studies: *Isaria*, *Haplaria*, *Synsporium*, *Monacrosporium*, *Trichosporium*, *Sporotrichum*, *Acremoniella*, *Graphium*, *Pachybasium*, and *Spicaria*.

CROWELL (I. H.). **A tweezers method for making microscopic sections of plant pathological material.**—*Mycologia*, xxxiii, 3, pp. 335–337, 6 figs., 1941.

For making preparations of diseased plant material, the author uses forceps about 3 in. long with either straight or curved ends sharpened to a knife edge, which permits the infected epidermis to be cut through

and then stripped off and mounted with a minimum of disturbance in lactophenol or glycerine jelly. The stripping of fine hair-like strands may be performed in a plane at right angles to the leaf surface of grasses and other monocotyledons to show the relationship of submerged stromata to the host tissue.

FRAHM-LELIVELD (J. A.). **A triple stain method for mycorrhiza in root cells.**—*Natuurwet. Tijdschr. Ned. Ind.*, ci, 4, pp. 114–115, 1941.

The following cytological method was employed at the Central and East Java Experiment Station, Malang, in the study of root cells of *Asarum europaeum* [asarabacca, a medicinal plant] infected by a mycelium of the *Rhizoctonia* type. The material is fixed for 24 hours in 1 part 2 per cent. osmic acid solution and 2 parts each of 1 per cent. chromic acid and 3 per cent. potassium bichromate; after 30 minutes' rinsing in distilled water the pieces are transferred to a mixture of 1 part pure pyroligneous acetic acid and 1 per cent. chromic acid for 24 hours, followed by another half-hour's rinsing. Post-chromatization is effected by three to six days' immersion in 2 per cent. potassium bichromate, after which the material is washed out for 24 hours in tap water, dehydrated, and embedded in paraffin. The unbleached microtome sections were stained with methyl (cotton) blue and safranin in lactophenol-alcohol. The cell walls, part of the protoplasmic contents, the secondary thickenings of the wood vessels, and the walls of the living mycelium in the host cells stain red; the mycelial contents stain blue, and the glomerules of ingested hyphae black. In the external cortical cells that serve as host cells, only the outer walls and the starch grains stain blue and their contents remain unstained, whereas in the layers in which ingestion proceeds the grains are uniformly swollen and usually burst, the walls staining blue and the contents red.

KÖHLER (E.). **Eine übersehene Kartoffelvirose.** [An overlooked Potato virus.]—*Naturwissenschaften*, xxix, 26, p. 390, 1941.

In addition to leaf roll, potato samples from Silesia, Mark Brandenburg, Saxony, and Berlin were found on examination at the Biological Institute, Dahlem, to be extensively infected by a virus transmissible by means of the aphid *Myzus persicae* and grafting, but not through the juice. In field crops the virus appears to be virtually latent, but in combination with other viruses it provokes severe crinkle, sometimes accompanied by stunting, and is largely responsible for 'degeneration'.

In greenhouse plants raised from 'eyes', the first symptom of the disease is a pronounced upward rolling of the pinnae, similar to that associated with leaf roll but usually only transient; the leaves, moreover, remain soft and pliable and do not develop the chlorosis characteristic of leaf roll. In the Altgold and Wohltmann varieties the longitudinal growth of the shoots becomes accentuated, while in Altgold and Ackersegen the leaves are abnormally small and the pinnae exceptionally small and narrow. The foliage displays a faint, diffuse, yellowish-green tinge originating in the mid- and lateral veins of the pinnae and imparting to the entire plant a somewhat lighter aspect than that of normal stands. Anthocyanin spots are produced on the rolled leaves of Parnassia and Wohltmann.

Since severe crinkle is a typical symptom of the virus in mixed infections, the designation K (Kräusel) is proposed for it. The disease under discussion is obviously identical with that described by the writer in 1935 as 'rolling mosaic' [*R.A.M.*, xv, p. 246].

HEINZE (K.). **Die Entwicklung des Pfirsich- und Aprikosenanbaus in Deutschland bis zum Jahre 1938 als Ursache für die allmähliche Zunahme der Kartoffelvirosen.** [The development of Peach and Apricot cultivation in Germany up to the year 1938 as a cause of the gradual increase of Potato viruses.]—*Forschungsdienst*, xi, 1, pp. 50–59, 6 maps, 1941.

Official statistics are cited in support of the author's statements concerning the rapid and widespread extension of peach and apricot cultivation of recent years in Germany, a development calculated, if allowed to proceed unchecked, to terminate the production of healthy stocks of seed potatoes, since the aphid (*Myzodes* [*Myzus*] *persicae*) responsible for the transmission of potato viruses overwinters in the fruit trees [*R.A.M.*, xx, p. 420]. Störmer's warning (*Mitt. Landw., Berl.*, lii, pp. 904–906, 1937) that no naturally healthy potato-growing regions would be left in Germany within a few years owing to the progress of degeneration from west to east failed to receive the attention it merited, but his fears may well be realized unless a drastic limitation of peach- and apricot-growing is enforced, at any rate along the north German coast for a distance of some 150 km. inland.

SCOTT (R. J.). **The effects of mosaic diseases on Potatoes.**—*Scot. J. Agric.*, xxiii, 3, pp. 258–264, 1941.

Investigations carried out to obtain statistical information as to the effect of the various types of mosaic disease found in Scotland, leaf roll, and 'wilding' [*R.A.M.*, xx, p. 30] upon the yield of potatoes showed that the presence of virus disease leads to earlier ripening. Negligible mottle, usually caused by mild strains of virus X, but sometimes due to virus A, may reduce the yield of ware by 16 to 25 per cent. Mild mosaic, generally caused by virus X, but very occasionally by virus A in combination with mild strains of virus X, may reduce the yield of ware by 30 to 40 per cent. Border-line severe mosaic, generally due to a combination of A and X, but also caused by severe strains of X, may reduce the yield of ware by 40 to 50 per cent. Severe mosaic, caused by a combination of A with the more severe strains of X, and by Y alone or in combination with A or X (virus Y is rather uncommon in Scotland), may reduce the yield of ware by 65 to 85 per cent. Leaf roll reduces the yield of ware by 75 to 90 per cent. While the total yield from 'wilding' types may approximate to that from normal plants, the condition reduces the yield of ware by 50 to 95 per cent.

Severe mosaic increases two- to threefold, and leaf roll fourfold from year to year.

Methods for controlling the mosaic group comprise the use of varieties virtually immune from A and X (e.g., King Edward, Epicure, Ninetyfold, Edgecote Purple, International Kidney, and Craig's Defiance), the planting of the highest grade 'seed', adequate isolation, care being taken never to plant X- near A-carriers, thorough roguing, especially

in the early part of the season, and roguing for mild forms of mosaic as drastically as for the more severe. Leaf roll and 'wildings' are controllable by the use of high grade seed and thorough roguing.

LARGE (E. C.). **Potato blight.**—*J. Minist. Agric.*, xlviii, 1, pp. 22–28, 1941.

In this brief popular account of potato blight [*Phytophthora infestans*] and its control, the author expresses the view that if weather conditions favour infection in 1941, it may be assumed that where preventive methods are not applied, the direct loss of crop due to blight will be from $\frac{1}{2}$ to 3 tons per acre, according to the district, with an additional wastage of like amount due to the decay of affected tubers in the soil, in transit, or in clamp.

HAWKES (J. G.) & HOWARD (H. W.). **Salaman's culture of blight resistant 'Aya papa'.**—*Nature, Lond.*, cxlviii, 3740, p. 25, 1941.

Cytological examination of root tip preparations from Salaman's culture of 'Aya papa', the plant from Ecuador reported to be resistant to *Phytophthora infestans* [cf. *R.A.M.*, xix, p. 40; xx, p. 380], showed that the specimen was a pentaploid with 60–62 somatic chromosomes, and therefore confirms Reddick's suggestion that it is a hybrid between *Solanum demissum* ($2n = 72$) and *S. tuberosum* ($2n = 48$). The plant also had many morphological similarities with *S. demissum*. The original Aya papa plant collected by Knappe was found by Bukasoff and Black to be susceptible. The descriptions of these two workers do not agree with Salaman's culture. Further, one of the present authors when in Riobamba, Ecuador, ascertained that potatoes known locally as Aya papa did occur in certain districts, where they grew wild. All the evidence indicates that Knappe's Ecuadorean potato is not blight-resistant and that this quality has not yet been discovered outside Mexico.

SKAPTASON (J. B.) & BLODGETT (F. M.). **Reduced toxicity of cuprous oxide to Phytophthora infestans (Mont.) De Bary by the addition of certain insecticides.**—*Amer. Potato J.*, xviii, 6, pp. 179–180, 1941.

The results of four years' experiments on Long Island, New York, to determine the effect on the toxicity to potato blight (*Phytophthora infestans*) of the admixture with cuprous oxide of insecticides, such as pyrethrum, rotenone, and sulphur, showed an increase in the number of lesions in the plants treated with the combined preparations as compared with those dusted with copper oxide alone, but only in the case of rotenone were the figures considered to be factorially significant (F value 57·2); the other F values ranged from 14·8 to 43·5. Previous experiments (*Amer. Potato J.*, xviii, pp. 1–9, 1941) having shown that the inclusion of cuprous oxide with insecticides in no case reduced the toxicity of the latter, the present results are of some interest and may be practically significant.

BRIEN (R. M.). **'Leak', a watery wound-rot of Potatoes in New Zealand.**—*N.Z. J. Sci. Tech.*, A, xxii, 4, pp. 228–231, 2 figs., 1940.

The fungus isolated from stored potato tubers affected by the watery

wound rot commonly known as 'leak' in New Zealand was found to be identical with *Pythium ultimum* [*R.A.M.*, xiv, p. 605]. Inoculation experiments with potato dextrose agar cultures of the fungus on Arran Chief tubers gave positive results. The disease may be responsible for heavy losses under humid conditions and at a temperature range of 20° to 30° C.

RUEHLE (G. D.). **Bacterial soft rot of Potatoes in southern Florida.**—*Tech. Bull. Fla agric. Exp. Sta.* 348, 36 pp., 6 figs., 1940.

*Erwinia carotovora* [with which *E. phytophthora* is regarded as synonymous by some authors: *R.A.M.*, x, p. 125; xvi, p. 404; xix, p. 427] was identified as the agent of a bacterial soft rot of washed potatoes in Florida, which has been under investigation since 1936, and its pathogenicity established by inoculation experiments. In the field the development of infection is closely associated with rainy weather, causing waterlogging of the soil, and with the presence of other diseases, especially late blight [*Phytophthora infestans*], while washing the tubers and packing them in crates in a wet condition increases the risk of storage rot. The pathogen may gain ingress through cuts, bruises, or cracks made in handling, or spread from decayed to sound tubers during transit or storage. In wet soils, moreover, the bacterium may enter the tubers through the lenticels or by way of lesions produced by other agents.

By means of a specially constructed apparatus for the maintenance of fairly constant temperature and humidity, the writer carried out experiments to determine the effect of various drying methods, of chilling, and of treatment with sodium hypochlorite on the development of soft rot. The disease was controlled by rapid drying of the tuber surfaces, before or soon after packing, by four minutes' exposure to an atmosphere of 150° F., three minutes at 130° sufficing under most conditions if the air was circulated rapidly round the tubers; on the other hand, ordinary air blasts from fans or blowers do not give thorough drying on a commercial scale in an extremely humid atmosphere, the effect of the treated air being largely offset by the cooling influence of evaporation from the tuber surfaces. Since the initiation of hot air-drying in two large packing houses at Goulds, in 1939 and 1940, not a single shipment of tubers has been rejected on account of soft rot. Pre-cooling washed potatoes after the car is loaded, either with mechanical refrigeration units installed outside the car or with portable fans and ice in the bunkers, eliminated most of the decay in shipments, but these methods were both more costly and less reliable than drying with heated air. Sodium hypochlorite at dilutions of 1 in 200 or 1 in 100 failed to give adequate control of bacterial soft rot.

A study of packing-house conditions indicated that the washing of tubers by spray jets is less conducive to soft rot than immersion in tanks. In the field the disease may be combated by planting the seed pieces in well-aerated soil, spraying or dusting the growing crop with copper fungicides, and care in harvesting to reduce mechanical injuries to a minimum.

ADAIR (C. R.). **Inheritance in Rice of reaction to Helminthosporium oryzae and Cercospora oryzae.**—*Tech. Bull. U.S. Dep. Agric.* 772, 18 pp., 1941.

The results of studies at the Arkansas Agricultural Experiment Station from 1934 to 1938 on the inheritance among the progeny of crosses between a number of rice varieties of reaction to *Helminthosporium oryzae* [*Ophiobolus miyabeanus*] and *Cercospora oryzae* [*R.A.M.*, xx, p. 222] indicated that several genetic factors are operative in the case of the former disease, resistance in the particular crosses analysed (Mubo Aikoku × Supreme Blue Rose) being recessive. Time of heading and lemma and palea apex colour were inherited independently of the factors governing reaction to *O. miyabeanus*.

Supreme Blue Rose, susceptible to *C. oryzae*, was found to carry at least one factor for susceptibility dominant to the factor controlling the response of the resistant varieties, Akaho, Meshibu, and Gin Bozu (C.I. 6355 and 6873). The factor determining the reaction of the resistant varieties to *C. oryzae* is dominant to that for susceptibility in Zenith, Early Prolific, and Carolina Gold. Physiological, rather than morphological or anatomical characters appear to form the basis of differences in varietal reactions to *C. oryzae*.

SAKAMOTO (M.). **On the facilitated infection of the Rice blast fungus, Piricularia oryzae Cav. due to the wind. I.**—*Ann. phytopath. Soc. Japan*, x, 2–3, pp. 119–126, 1940. [Japanese, with English summary.]

Rice blast (*Piricularia oryzae*) [*R.A.M.*, xx, p. 275] having been observed to develop in epidemic form following rough weather, plants were subjected for several hours to an artificial strong wind prior to inoculation with the pathogen. The treatment was followed by a marked increase of infection, attributable mainly to the facilitated ingress of the fungus through abrasions resulting from interfoliar friction under the influence of the wind, though resistance may possibly have been lowered by excessive dryness or mechanical injuries brought about by the same agency.

TERUI (M.). **Internal formation of conidia of the Rice blast fungus.**—*Ann. phytopath. Soc. Japan*, x, 2–3, pp. 265–268, 1 pl., 1 fig., 1940. [Japanese summary.]

The microscopic examination of transverse sections of the leaf blades of Akage No. 3 rice plants inoculated with spore suspensions of *Piricularia oryzae* [see preceding abstract] and kept under controlled conditions in a greenhouse at the Hokkaido Imperial University, Sapporo, revealed the profuse development of hyphae, conidiophores, and conidia in some of the lysigenous cavities along the midrib. Similar observations were made in material from the leaf sheaths, while the epidermal cells, parenchymatous tissues, vascular bundles, and central hollow cavities of the culm also contained the above-mentioned organs in abundance. The conidia formed internally are shorter than those produced on the exterior of the plant, the widths being about equal in both types. Conidiophores and conidia were also formed in large

numbers on the inner surface of the bract bases. Some of the conidia developing in the lysigenous or hollow pith cavities were found to have germinated *in situ*, and presumably they would be capable of infecting the surrounding tissues. Possibly the internal conidia may also be instrumental in the perpetuation of the rice blast fungus from one season to the next, so that diseased straw should be excluded from the vicinity of the rice fields to prevent primary infection from this source.

Yabuta (T.) & Hayasi (T.). **Biochemical studies of 'bakanae' fungus of Rice.**—*J. imp. agric. Exp. Sta.*, iii, 3, pp. 365–400, 7 pl., 1940. [Japanese, with English summary.]

This is a fully tabulated account of studies on the biochemical aspects of the 'bakanae' (elongating) disease of rice (*Gibberella fujikuroi*) in Japan, some of the results of which have already been noticed from another source [*R.A.M.*, xix, p. 726]. Fusaric acid produced by the fungus is so toxic that a concentration of 1 in 1,000,000 causes injury. Gibberellin, another product, makes the seedlings grow abnormally tall.

Vlassova (Mme E. V.) & Chariton (E. G.). Роль гриба **Trichoderma lignorum** в регулировании состава микрофлоры почвы. [The influence of the fungus *Trichoderma lignorum* on the composition of soil microflora.]—Научн. зап. по Сахарн. Пром. [*Sci. Notes Sug. Ind.*], Kieff, [Grey Ser.], xvii, 1–2, pp. 125–127, 1940.

Following inoculation of the soil with *Trichoderma lignorum* [*T. viride*: see below, p. 508, and next abstracts] in a field near Kieff, Ukraine, the fungus was found to persist in the soil under all crops of the sugar beet rotation (wheat, beet, lupin, oats, and clover), even as late as one year after inoculation at depths of 10 and 20 cm. The addition of plant remains to the soil stimulated the development of the fungus, which increased from between 0 and 3,000 to 30,000 per gm. of soil. The same increase was observed a fortnight after harvesting wheat or oats, the fungus increasing at the cost of decaying roots. The average numbers of soil bacteria and fungi in fields planted with sugar beet was noticeably reduced following soil inoculation with *T. viride*, but in lupin fields the numbers were increased, more especially at a depth of from 23 to 25 cm. than at from 12 to 14 cm. In clover plots inoculated with *T. viride* the population of soil fungi increased to 213,000 as compared with 110,000 in the uninoculated plot. Cultures of *T. viride* in Petri dishes survived a 20 hours' exposure to bright sunlight. In the field, inoculum of the fungus withstood frost temperatures of —21° in the almost complete absence of snow.

Tatounko (V. D.). Влияние заражения почвы микроорганизмами на превращения органического вещества. [The effect of the infection of soil with micro-organisms on the transformation of organic matter.]—Научн. зап. по Сахарн. Пром. [*Sci. Notes Sug. Ind.*], Kieff, [Grey Ser.], xvii, 1–2, pp. 121–122, 1940.

In laboratory and field experiments conducted during 1938 in the Ukraine it was found that soil inoculated with *Trichoderma lignorum* [*T. viride*: see preceding and next abstract] resulted in an intensified decomposition of organic matter and an increased mineralization of the

nitrogen content of the soil, which is assumed to be mainly responsible for yield increases in crops. Thus, 100 days after the beginning of the experiment, soil inoculated with *T. viride* was found to contain 17·34 mg. of nitrate nitrogen and 22·8 mg. of phosphoric acid per 100 gm. of absolutely dry soil as against 10 and 21·6 mg., respectively, in the uninoculated control. The largest amounts of carbon dioxide were given out by soils inoculated with *T. viride*, followed by those inoculated with *T. viride* plus *Aspergillus niger*, plus *Azotobacter*.

HINO (I.) & ENDÔ (S.). **Trichoderma parasitic on sclerotial fungi.**—*Ann. phytopath. Soc. Japan*, x, 2–3, pp. 231–241, 2 figs., 1940. [Japanese, with English summary.]

*Trichoderma viride* [see preceding abstracts] has been found to parasitize and often destroy the sclerotia and mycelia of certain pathogenic fungi, e.g., *Corticium rolfsii* [*R.A.M.*, xvii, p. 763], *C. sasakii* [ibid., xviii, p. 617], and *Sclerotinia libertiana* [*S. sclerotiorum*] in Japan. Although *T. viride* is a weak parasite of sweet potatoes and tends to impair the growth of various other crops, its deleterious action on the above-mentioned soil pathogens is considered to outweigh these drawbacks, and hopes are entertained of its application in the biological control of plant diseases [cf. ibid., xx, p. 322].

SZILVINYI (A. V.). **Mikrobiologische Bodenuntersuchungen im Lunzer Gebiet. III. Teil.** [Microbiological soil analyses in the Lunz region. Part III.]—*Zbl. Bakt.*, Abt. 2, ciii, 9–11, pp. 133–189, 47 figs., 1941.

Of the 1,051 strains of soil fungi isolated from 46 soil samples at the Lunz-am-See (Austria) Biological Station from 1930 to 1932, 243 were cultured for a further eight years and specifically identified. The species represented numbered 157, of which 46 were new [and are described with Latin diagnoses] and 30 were new varieties; of the genera represented 36 belonged to the Hyphomycetes and 5 to the Phycomycetes.

DENNIS (R. W. G.). **Plants and manganese.**—*Fertil. Feed St. J.*, xxvi, 13, pp. 187–188, 190; 14, pp. 205–207; 15, pp. 219, 221–222; 16, pp. 235, 237, 2 figs., 1941.

This is a useful, fully documented survey of important contributions to the knowledge of the manganese requirements of plants, the history of the subject, and its applications in various countries in the control of manganese deficiency diseases of economic crops.

D'OLIVEIRA (MARIA DE L.). **Dois virus de Pimento.** [Two Chilli viruses.]—*Agron. lusit.*, ii, 3, pp. 209–223, 1 pl., 1940. [English summary.]

In 1937, two virus diseases of chilli (*Capsicum annuum*) were investigated in Portugal, and found on the basis of inoculation tests, and physical and chemical properties, to be due, respectively, to the tobacco mosaic virus in the Elvas district and the cucumber mosaic virus at Algarve [*R.A.M.*, xvii, pp. 139, 773; xix, p. 61]. In the field the symptoms of the two diseases are liable to confusion, but under controlled conditions tobacco mosaic virus induces slight stunting, a large mosaic pattern on the leaves, accompanied by a certain amount of

rugosity in severe cases, and heavy reductions in yield, while plants infected by cucumber mosaic virus present a rigid, denuded aspect, the leaves being abnormally narrow and pointing downwards, with a profusion of axillary buds; here also the abscission of the floral buds involves a drastic diminution of output, one grower reporting a decrease per plant from 120 to 20 or 25 gm. of the dried product.

Both viruses spread rapidly in the field, the mode of transmission of the tobacco mosaic virus being obscure, while insects are chiefly instrumental in the conveyance of that of cucumber mosaic from diseased to healthy plants. *Solanum nigrum* and *Datura stramonium* were often observed to be infected by tobacco mosaic in chilli plantings, while cucumber mosaic is widespread throughout the country, both on cultivated and wild plants. Seed transmission could not be demonstrated in the case of either virus.

Inoculation experiments with the juice of tobacco mosaic-infected chilli plants gave positive results on White Burley tobacco, *Nicotiana rustica*, *N. texana*, *Hyoscyamus niger*, *D. stramonium*, tomato, *S. nigrum*, and *S. nodiflorum*, and with cucumber mosaic-infected tobacco, *N. glutinosa*, *D. stramonium*, and tomato.

The economic importance of both viruses is regarded as considerable in view of their immense facilities for dispersal, their capacity for persistence in the soil or on alternative hosts, and the virtual impossibility of combating established infections. Control measures can only be of a prophylactic character and should include, in the case of tobacco mosaic, judicious crop rotation and care in the handling of young plants at transplanting and in cultural operations, and in that of cucumber mosaic, the avoidance of conditions promoting insect propagation.

RAMAKRISHNAN (T. S.) & NARASIMHALU (I. L.). **A new host—Ricinus communis—for Léveillula taurica (Lév.) Arn. [Oidiopsis taurica (Lév.) Salm.]**—*Curr. Sci.*, x, 4, pp. 211–212, 2 figs., 1941.

The authors record the occurrence of *Oidiopsis* (*Leveillula*) *taurica* on *Ricinus communis* in recent years at Coimbatore, a new host record. The disease is prevalent from November until March. The mildew is chiefly restricted to the lower surface of the leaves, but in advanced stages of severe infection the upper surface is affected as well. The spore measurements averaged 67·3 by 18·7$\mu$.

RAMAKRISHNAN (T. S.). **Root-rot of Sugarcane.**—*Curr. Sci.*, x, 5, pp. 254–255, 5 figs., 1941.

From the rotted tissues of Co. 413 sugar-cane roots at the Agricultural Research Institute, Coimbatore, the author in 1939 isolated on Quaker oat agar a species of *Pythium* characterized by oogonia each provided with one to four antheridia and measuring 21 to 29·4 (average 26·7) $\mu$ in diameter, the cavities of which are largely occupied by spherical, smooth oospores, 18·9 to 25·2 (22·5) $\mu$: the spherical or oval sporangia are produced at the ends of long stalks and give rise to vesicles, each liberating 16 to 20 zoospores; meanwhile a hypha begins to grow through the sporangium and sometimes branches out into a mycelium. The fungus resembles *P. de Baryanum*, the agent of

a sugar-cane root rot in Louisiana [*R.A.M.*, xviii, p. 343], except in its larger oogonia and oospores. The pathogenicity of the organism was established by inoculation experiments on the roots of Co. 413 plants in pots. Le Beau observed in Louisiana that the incidence of root rot was increased by nitrate fertilizers [ibid., xviii, p. 618], and a similar relationship was noted at Coimbatore, where the trouble began after the application of ammonium sulphate to the fields.

KIRYU (T.). **On a method of varietal resistance trials of Sugar Cane to red rot.**—*Ann. phytopath. Soc. Japan*, x, 2–3, pp. 156–170, 4 figs., 1940. [Japanese, with English summary.]

At the Government Sugar Experiment Station, Tainan, Formosa, sugar-cane varieties are tested for their reaction to red rot (*Colletotrichum falcatum*) [*R.A.M.*, xiv, p. 657] by the inoculation of 30 to 40 stalks of each variety with fragments of four-day-old cultures on cane juice agar maintained at 28° C., inserted into apertures 7 mm. in diameter punched in the centre of the internode. Two to three months later, at harvest time, the inoculated stalks are split lengthwise and the extent of the diseased tissue measured.

The resistance of a given variety to the pathogen is computed by the 'theoretical figure' derived from the number of diseased internodes. When the area of the affected portion of the inoculated stalk comprises more than $\frac{2}{3}$ of an internode, it is placed under the sign +++, between $\frac{2}{3}$ and $\frac{1}{3}$ under ++, and below $\frac{1}{3}$ under +. The number of infected internodes in the +++ category is then multiplied by $\frac{3}{3}$ and those in ++ and + by $\frac{2}{3}$ and $\frac{1}{3}$, respectively. The degree of damage (b) is arrived at by dividing the total sum of the three categories of each variety by the number of stalks measured. The ratio (b′), the quotient of the figure of damage of each variety by that of the standard one (P.O.J. 2725), then becomes the theoretical figure for the comparison of resistance of each variety. Where b′ in a given variety is above 1, that variety is less resistant than the standard, whereas a variety in which b′ is below 1 is more resistant than the standard.

The varietal data secured in these tests, which have been in progress since 1936, are tabulated.

KRENNER (J. A.). **Einige mykologische und pflanzenpathologische Angaben aus Ungarn.** [Some mycological and phytopathological data from Hungary.]—*Bot. Közl.*, xxxviii, 1–2, pp. 62–67, 1 fig., 1941. [Hungarian and German.]

Included in this critically annotated list of 47 Hungarian fungi and four bacteria are a number of new records for the country, among which may be mentioned *Bacillus* [*Erwinia*] *dahliae* in living dahlia rhizomes, *Bacterium sorghi* on sorghum [*R.A.M.*, xviii, p. 518], *Pseudomonas mori* on mulberry leaves, *P. pelargonii* on *Pelargonium zonale* foliage [ibid., x, p. 461], *Pleosphaerulina briosiana* [ibid., xvi, p. 279], *Colletotrichum trifolii*, and *Gloeosporium morianum* on lucerne, *Excipulina pinea* [*Crumenula abietina*] on pine (*Pinus sylvestris*) [ibid., vii, p. 209; xx, p. 41], *Septoria linicola* [*Sphaerella linorum*] on flax, *Fusicladium radiosum* [*Venturia populina*] on poplar (*Populus virginiana*) [ibid., xix, p. 387], and *Heterosporium variabile* on spinach.

Unamuno (L. M.). **Nueva contribución al estudio de los hongos microscópicos de la flora española.** [A further contribution to the study of the microscopic fungi of the Spanish flora.]—*An. Jard. bot. Madr.*, i (*1940*), pp. 9–58, 13 figs., 1941.

The following are among the 107 species, four of which are new, comprised in this critically annotated list of fungi collected of recent years, largely by the author, in the north of Spain [*R.A.M.*, xx, p. 382]. *Alternaria carolinaeana* n.sp. [with a Latin diagnosis] is characterized by polymorphous, long-beaked, brown to fuligineous conidia, 43 to 150 by 10·7 to 21·5 $\mu$, with 7 to 15 transverse, and 3 to 5 longitudinal septa, borne on simple, cylindrical, straight or slightly arcuate, bi- to triseptate, brown, subfasciculate conidiophores, 43 to 64·5 by 12 to 19 $\mu$, and forms on *Dahlia variabilis* leaves numerous scattered, circular, ellipsoid, subcircular, or angular, brown, later pallid spots 3 to 10 by 2 to 6 mm. in diameter. *Tilletia controversa*, distinguishable from *T. tritici* [*T. caries*] by its more translucent spores with irregularly polygonal edges and lines 2 to 3 $\mu$ in length, a new record for Spain, was found on the ovaries of *Agropyron diazii* (= *A. pouzolzii* × *A. sativum*). *Puccinia menthae* was observed on the leaves of *Satureia grandiflora* (a new host for the country) and *Mentha longifolia* [loc. cit.] (in conjunction with *Erysiphe lamprocarpa* on the latter). Two other rusts recorded for the first time in Spain are *P. schroeteri* on the foliage of *Narcissus pseudo-narcissus* [ibid., xiv, p. 366], 1,390 m. above sea-level, and *Uropyxis* [*Cumminsiella*] *sanguinea* on barberry leaves [ibid., xviii, p. 654].

Caballero (A.). **Micromicetos del Jardín Botánico de Valencia.** [Micromycetes of the Botanic Garden of Valencia.]—*An. Jard. bot. Madr.*, i (*1940*), pp. 173–200, 15 figs., 1941.

Two new genera, 23 new species, and one new variety [with Latin diagnoses], are included in this critically annotated list of fungi represented in the herbarium of the Botanic Garden, Valencia, Spain, among which may be mentioned *Phyllosticta apicalis* n.sp., forming pallid, later purplish-black, expanding spots on the leaf tips of *Phormium tenax*.

Rayss (T.). **Nouvelle contribution à l'étude de la mycoflore de Palestine (deuxième partie).** [A new contribution to the study of the mycoflora of Palestine (second part).]—*Palest. J. Bot.*, J Ser., i, pp. 313–335, 3 figs., 1940.

This further instalment of the writer's critically annotated list of Palestinian fungi [*R.A.M.*, xviii, p. 275] comprises 45 species, of which one, *Oidium matthiolae* on living *Matthiola incana* leaves, is regarded as new ad int. [with a Latin diagnosis]. It is characterized by ascendant or erect conidiophores, with few septa, and ovoid or barrel-shaped, smooth, hyaline, bi- to tricatenulate conidia, 30 to 40 by 12 to 16 $\mu$.

Wakefield (E[lsie] M.) & Bisby (G. R.). **List of Hyphomycetes recorded for Britain.**—*Trans. Brit. mycol. Soc.*, xxv, 1, pp. 49–126, 1941.

This compilation (the third list of British fungi to be completed in

conformity with the recommendations of the Plant Pathology Committee of the British Mycological Society) [cf. *R.A.M.*, xx, p. 179] is preceded by an introduction tracing the history of previous work on the Hyphomycetes. The authors accept E. W. Mason's division of these fungi into two main groups, one with moist or slimy spores and one with dry spores (*Annot. Acct Fungi recd I.M.I.*, List II, Fasc. 3, general part, pp. 68–99, 1937) and they name the former group Gloiosporae and the latter Xerosporae. Each of these two groups is divided into only Amerosporae, Didymosporae, Phragmosporae (including Scolecosporae, as the implied distinction often does not hold); there are also Dictyosporae, Helicosporae, and Staurosporae among the British Xerosporae, and a group of Endosporae placed in the Gloiosporae. The Mycelia Sterilia follow, after which come a few records in excluded, unknown, or uncertain genera. Dermatophytes and conidial stages of powdery mildews are omitted. A total of 1,208 Hyphomycetes is included in the list.

PADWICK (G. W.). **The genus Fusarium, V. Fusarium udum Butler, F. vasinfectum Atk. and F. lateritium Nees var. uncinatum Wr.**— *Indian J. agric. Sci.*, x, 6, pp. 863–878, 3 pl. (2 col.), 1940.

In continuation of his studies on the genus *Fusarium* [*R.A.M.*, xx, p. 232], the writer proceeds with the critical discussion of the identity of the various isolates responsible for wilt in cotton, pigeon pea (*Cajanus cajan*), and sunn-hemp (*Crotalaria juncea*), cultures of which were grown for comparison on 2 per cent. potato dextrose agar, Brown's agar with and without starch, and steamed rice, the resultant data being fully tabulated.

The cultures causing typical severe wilt in pigeon pea and *C. juncea* differed from those of *F. vasinfectum*, the agent of the disease in cotton, in three important features, viz., the production of abundant spores in pionnotes, the marked apical hook of the conidia, and the bright orange and yellow of the steamed rice substratum, *F. vasinfectum* forming few or no pionnotes, its conidia being curved but not hooked, and the colour of the rice medium being red (deep purple on the addition of 2 per cent. potassium hydroxide). Several cultures weakly parasitic on *C. juncea* produced conidia considerably exceeding in breadth those of *F. vasinfectum* or the typical pigeon pea and sunn-hemp organisms, and probably referable to the section *Martiella*.

The typical agents of wilt in pigeon pea and *C. juncea*, though clearly distinguishable on a parasitic basis, are identical morphologically and culturally and should both be referred to *F. udum* [ibid., xvii, p. 652], a highly variable species, especially in respect of capacity for chlamydospore formation, spore length, and range of pigmentation. A comparison of a number of isolates of *F. udum* with *F. lateritium* var. *uncinatum* [ibid., xvii, p. 651], as well as with cultures of all varieties and physiologic races of *F. vasinfectum* from the Centraalbureau voor Schimmelcultures, Baarn, Holland, afforded striking confirmation of the previous conclusion that *F. udum* and *F. vasinfectum* are distinct species, besides establishing *F. lateritium* var. *uncinatum* as a synonym of *F. udum*.

The names *F. udum* Butl. var. *cajani* and *F. udum* Butl. var. *crota-*

*lariae* are proposed for the organisms inducing wilt of pigeon pea and *C. juncea*, respectively.

SHEAR (C. L.). **Mycological notes. V.**—*Mycologia*, xxxiii, 3, pp. 318–332, 1941.

In these critical notes on some of the common North American Pyrenomycetes, the author points out that *Rosellinia aquila* [*R.A.M.*, xvii, p. 601], regarded by various authors as one of the commonest species in the United States, has only been found by him in two collections from that country, all other herbarium specimens labelled *R. aquila* which he examined being *R. corticium* or some other species. The synonymy of the two species is discussed.

DE HAAN (I.). **Gebrekverschijnselen bij Thee veroorzaakt door een tekort aan de belangrijkste minerale voedingsstoffen met uitzondering van kalium.** [Deficiency symptoms on Tea caused by a shortage of the principal mineral nutrient substances, with the exception of potassium.]—*Arch. Theecult. Ned.-Ind.*, xv, 1, pp. 1–32, 3 col. pl., 1 fig., 1 graph, 1941. [English summary.]

A comprehensive, fully tabulated account is given of the writer's observations at the West Java Experiment Station from 1937 to 1940 on the symptoms of tea plants, grown from cuttings in pots filled with quartz sand and deprived severally of the principal nutrient elements, except potassium, the effects of a deficiency of which have already been discussed [*R.A.M.*, xx, p. 363].

Lack of calcium was chiefly apparent in the half-grown leaves, the interveinal spaces along the margins of which developed pale green patches, subsequently shrivelling and turning dark brown, while the growth of the veins was arrested, resulting in an upward curvature of the leaf edges; the mature foliage acquires a brittle texture.

The fully-developed leaves of plants deprived of magnesium assumed a pale yellow tinge, except for the areas immediately adjacent to the veins, and showed a tendency to convex bulging. A less characteristic feature was the appearance of brown, necrotic patches at the vein-endings near the leaf margins. This condition has been observed in tea plantations along the east coast of Sumatra, in two of which the magnesium content of the leaf ash was 3·04 and 2·46 per cent., respectively, compared with 9·30 per cent. in that of samples from normal soil; in the sand cultures with no magnesium the corresponding figure was 3·3 per cent.

Apart from a somewhat unusually dark coloration of the leaves, no symptoms of phosphorus deficiency developed until after pruning in 1939, when a dull, dark- to bluish-green tinge became noticeable, while in some cases the tips shrivelled and turned dark brown; at the end of 1940 reddish-brown spots appeared along the margins, presumably representing an advanced stage of the shortage. The production of a new flush of leaves after pruning was much diminished. A bluish-green tint has sometimes been observed on the foliage of bushes recently subjected to low pruning in plantations on phosphorus-deficient soils.

Lack of nitrogen was expressed by the production of small, pale yellow

leaves, pointing stiffly outwards, or in extreme cases by the complete cessation of all further development. These symptoms may often be seen in plantations on poor soils.

Symptoms of sulphur deficiency [ibid., xii, p. 537] have not been noticed in Java or Sumatra.

THOMPSON (A.). **Branch canker of Tea.**—*Malay. agric. J.*, xxix, 4, pp. 152–154, 1 pl., 1941.

Tea bushes in the Cameron Highlands, Malaya, growing on an area undergoing pruning for the second time, were found to show cankers, evidently not of recent origin, on the upper surface of horizontal branches. The lesions ranged from 2 to 6 in. long by ½ to 1½ in. wide; no fungus was seen on any bush examined, and the only one which developed in culture from the margins of typical cankers was a species of *Diplodia*.

The location of the cankers and the fact that the bushes were growing in a situation exposed to the sun during the heat of the day are considered to indicate that the condition was due to sun scorch at pruning. The most satisfactory method of control would probably be the provision of overhead shade.

VAN SCHREVEN (D. A.). **Control of Tobacco mosaic by means of extracts of tanning substances.**—*Natuurwet. Tijdschr. Ned. Ind.*, ci, 4, pp. 113–114, 1941.

At the Klaten (Central Java) Tobacco Experiment Station the writer investigated the action of various kinds of tannin on the tobacco mosaic virus [*R.A.M.*, xv, p. 178]. The hands of workers moistened with undiluted filtered juice of mosaic-diseased leaves were completely disinfected by washing in a 1·5 or 8 per cent. tannic acid solution extracted from galls on *Rhus semilata*, while a commercial tanning substance of unknown origin, in the form of a solid aggregate, produced the same effect at a strength of 0·5 per cent. A 15 per cent. tanning extract from the bark of *Acacia decurrens*, when added to juice from mosaic-diseased tobacco in equal volumes, inactivated the virus within half a minute, as demonstrated by rubbing the suspension on young tobacco leaves, while an aqueous extract of mangrove [? *Rhizophora*] bark, which also contains tannin, acted similarly. It is thought probable that all tannin-containing plants yield extracts capable of inactivating the tobacco mosaic virus, in which case its loss of virulence on treatment with *Phytolacca decandra* extract [ibid., v, p. 377] would be explicable by the tannin content of the foliage and fruits. Soil disinfection against the virus may also be carried out with a tannin extract solution. The addition of a standard fungicide to tannin solutions intended for keeping is requisite to prevent fungal deterioration. Tannin solutions are likewise effective against white mosaic, distorting mosaic [ibid., xix, p. 241], Holmes's masked strain, mild mosaic, ring spot necrosis, tobacco ring mosaic, and mosaic VI B [ibid., xviii, p. 207]. The tannin method of virus inactivation is equally effective with the trisodium phosphate treatment recommended by van der Weij [ibid., xx, p. 279], to which it is regarded as preferable owing to the absence of any irritant action on the skin.

VALLEAU (W. D.) & DIACHUN (S.). **Virus distribution in mosaic-resistant Tobacco and its relation to pattern development in susceptible varieties.**—*J. agric. Res.*, lxii, 4, pp. 241–247, 7 figs., 1941.

The distribution of the 'pure white' strain of the tobacco mosaic virus [*R.A.M.*, xviii, p. 823] within the leaves of resistant tobacco plants (hybrids of Ambalema × Burley tobacco) was found in Kentucky to be quite accurately indicated by the pattern of chlorotic spots to which the virus appeared to be almost entirely confined. The progress of the virus within the plant is assumed to take place by a long-distance movement of virus particles or aggregates of particles from points of inoculation and multiplication followed by slow cell-to-cell movement in the immediate vicinity of the point of lodgement of the virus particle. In resistant plants the multiplication of virus at the point of inoculation is slow and the virus is released only slowly or not at all for long-distance spread. It is suggested that the difference between the so-called slow- and rapidly-moving virus strains lies in the rate of multiplication of the virus rather than in rate of actual movement. The pattern development in susceptible tobacco plants may be deduced from observations on the distribution of the virus in resistant plants. It is stated that many of the different symptom complexes in susceptible tobacco caused by the different strains of the tobacco mosaic virus, such as mottled mosaic, ring mosaic, speckled mosaic, and others, can be duplicated in resistant tobacco by the use of a single virus strain on plants of different degrees of resistance.

VALLEAU (W. D.) & DIACHUN (S.). **Virus distribution in the leaves of mosaic-susceptible Tobacco plants inoculated at topping time.**—*J. agric. Res.*, lxii, 4, pp. 249–254, 2 figs., 1941.

In field and greenhouse experiments in Kentucky it was found that the advance of various strains of tobacco mosaic virus [see preceding abstract] inoculated into highly susceptible Burley tobacco plants at topping time was extremely slow if the leaves had attained almost full size. The top leaves of plants not yet in bloom were more rapidly invaded, but they matured before the infection had time to become general and the virus remained localized in scattered spots, which slowly increased in size. Uninoculated leaves of inoculated greenhouse plants were virus-free at the end of a month; at the end of two months only the midribs and laterals of some leaves were invaded but not the blade tissue. It is concluded from these results that infection at topping time can have little or no influence on the quality of the cured leaf if the plants are topped in the full bloom stage; if they are topped early, when the flower buds are just beginning to show, some upper leaves may be affected.

SPENCER (E. L.). **Inhibition of increase and activity of Tobacco-mosaic virus under nitrogen-deficient conditions.**—*Plant Physiol.*, xvi, 2, pp. 227–239, 1 graph, 1941.

In experiments made to ascertain how tobacco mosaic virus is affected in a plant deficient in nitrogen, Turkish tobacco seedlings grown in sand cultures and given a complete nutrient solution (nitrogen level, 200 p.p.m.) were inoculated with tobacco mosaic virus, the plants being divided ten days later into two groups, of which one continued

to receive the complete solution, while the other received a nutrient solution deficient only in nitrogen. Representative plants were removed from each group at intervals of four days, and the expressed juice was assayed for relative virus activity, total protein, and virus protein.

In the nitrogen-deficient plants the virus-protein content and the soluble plant-protein content remained almost constant, whereas in the plants that received nitrogen each increased more than 5 times in 16 days. No decrease was noted in the yield of virus protein in the nitrogen-deficient plants, but its biological activity showed over 40 per cent. reduction.

The evidence showed that in the nitrogen-deficient plants the virus protein acted as a foreign protein, the virus apparently being unaffected by the normal proteolytic processes of the host. Plants with severe nitrogen deficiency were unable to use in the synthesis of normal proteins any nitrogen previously utilized by the virus. The virus, however, was unable to utilize any nitrogen in the proteins normally present in a nitrogen-deficient plant, for in the absence of an external supply of nitrogen no further virus multiplication was detected.

NAKATA (K.) & TAKIMOTO (S.). **A white strain of common Tobacco mosaic.**—*Ann. phytopath. Soc. Japan*, x, 2–3, pp. 242–253, 1 col. pl., 14 figs., 1940. [Japanese, with English summary.]

A white mosaic of tobacco in the Hukuoka district of Japan, infectious to most Solanaceae and causing severe stunting of *Petunia*, is regarded as distinct from E. M. Johnson's white mosaic [*R.A.M.*, x, p. 60] and may represent a strain of the common tobacco mosaic virus (*Nicotiana* virus 1) capable of inducing a white mottling on tobacco. *N. sylvestris* also developed mottling on inoculation with the white mosaic virus.

BAWDEN (F. C.) & KASSANIS (B.). **Some properties of Tobacco etch viruses.**—*Ann. appl. Biol.*, xxviii, 2, pp. 107–118, 1 pl., 1941.

In studies on the properties of the tobacco etch viruses [*R.A.M.*, xix, pp. 241, 562] it was demonstrated that plants affected by severe or mild etch contain both intranuclear and cytoplasmic inclusions. The nuclei of plants with mild etch show fewer and larger crystals than those of plants with severe etch. Plants infected as seedlings with the severe etch virus (referred to as S.E.V.) develop malformed leaves, in which the cytoplasmic inclusions crystallize and give rise to bi-refringent needles. Plants affected by mild etch (M.E.V.) are thereby protected against infection with severe etch. That these two viruses are serologically related is shown by the fact that antisera prepared against either react with severe etch virus.

Though not serologically related to potato virus Y or *Hyoscyamus* virus 3, severe etch virus has similar properties *in vitro* and is transmitted in the same manner. The interactions of these three viruses in the plant suggest some relationship between them. Plants infected with potato virus Y or *Hyoscyamus* virus 3 are not protected against severe etch, and those infected with virus Y are susceptible to *Hyoscyamus* virus 3. Plants infected with severe etch, on the other hand, are protected against the other viruses, and those infected with *Hyo-*

*scyamus* virus 3 are protected against potato virus Y. Severe etch can suppress these two viruses when healthy plants are infected with a mixed inoculum, and can supplant them in tissues in which they are already established. Similarly, *Hyoscyamus* virus 3 can suppress and supplant potato virus Y.

WEBER (G. F.) & KELBERT (G. A.). **Seasonal occurrence of Tomato diseases in Florida.**—*Bull. Fla agric. Exp. Sta.* 345, 26 pp., 21 figs., 1 map, 1940.

Popular descriptions are given of some well-known diseases affecting the Florida tomato crop, with special reference to seasonal and environmental factors in relation to their development and control.

BRIEN (R. M.). **'Foot-rot' of Tomatoes caused by Phytophthora cryptogea.**—*N.Z. J. Sci. Tech.*, A, xxii, 4, pp. 232–236, 2 figs., 1940.

The foot rot of tomatoes caused by *Phytophthora cryptogea* [*R.A.M.*, xix, p. 70] was observed for the first time in New Zealand in 1938, its pathogenicity being established by inoculation experiments. Non-papillate sporangia measuring 24 to 50 by 16 to 31 (average 37 by 24) $\mu$ were produced only on infected tomato roots and stems held in Petri dishes containing moistened filter pads for three days at 23° C.

TOMPKINS (C. M.) & TUCKER (C. M.). **Buckeye of Tomato in California.**—*J. agric. Res.*, lxii, 8, pp. 467–474, 2 figs., 1941.

Buckeye rot of green tomato fruits has consistently been ascribed to *Phytophthora parasitica* by investigators in various countries, though Bewley reported that in England the rot may also be caused by *P. cryptogea* [cf. preceding abstract]. Isolations from 300 tomato fruits in 1938 and 1939 in California yielded only *P. drechsleri* [*R.A.M.*, xvi, p. 793] and *P. capsici* in the former year and *P. capsici* alone in the latter. In inoculation tests both species proved pathogenic to unwounded fruits, the incubation period being 11 days for *P. drechsleri* and 7 for *P. capsici*. The disease is stated to be prevalent in several interior valleys of central California. It is favoured by high temperatures and humidity and above all by contact of the fruit with moist soil or with irrigation water. In inoculation tests with the three species, Yellow Crookneck and Zucchini pumpkin and *Cucurbita pepo* var. *condensa* fruits were only infected by *P. capsici* and *P. parasitica*, bell pepper (*Capsicum annuum* var. *grossum*), Newton Pippin apple, and cucumber only by *P. capsici* [ibid., xx, p. 317], Purple Top White Globe turnip roots by *P. drechsleri* and *P. parasitica*, and carrot roots by *P. capsici* and *P. drechsleri*.

FAWCETT (G. L.). **La peste negra de los Tomates y la corcova del Tabaco.** [The 'black pest' of Tomatoes and 'corcova' of Tobacco.] —*Rev. industr. agríc. Tucumán*, xxx, 10–12, pp. 221–226, 3 figs., 1940.

In 1937, at the Tucumán (Argentine) Agricultural Experiment Station, the writer successfully transmitted the virus of 'black pest' (apparently identical with spotted wilt) of tomatoes from diseased to healthy tomato plants by means of *Frankliniella paucispinosa*, and

from infected tomato to sound tomato and tobacco plants by rubbing the leaves with an extract of juice from affected foliage, the latter method having been employed as early as 1933, when the first indication that 'black pest' and 'corcova' [hunchback] of tobacco [*R.A.M.*, xix, p. 8; xx, p. 105] were due to the same virus was obtained. On this occasion, 9 out of 20 tobacco plants inoculated with the 'black pest' virus from tomatoes contracted the typical symptoms of 'corcova', while between 1933 and 1937, 5 out of 19 plants similarly treated developed 'corcova'. In 1940, all the four tobacco plants inoculated with 'black pest' displayed the 'corcova' symptoms, while conversely, two tomatoes treated with juice from 'corcova' tobacco plants rapidly developed 'black pest'. In 1937 *F. paucispinosa* conveyed 'corcova' from tobacco to tomato. Both diseases are likewise intertransmissible by grafting.

The 'black pest' virus has been inactivated in some tests at 38° C. and in others at 40°.

Attention is drawn to a minor difference between the 'kromnek' disease (spotted wilt) of tobacco in South Africa [ibid., xiii, p. 129] and 'corcova' in the Argentine, consisting in the absence in the latter of the discontinuous, vitreous, later dark lines on the leaves characteristic of the former. Moreover, tomatoes affected by 'black pest' in the Argentine do not show the yellow mottling associated with the disease elsewhere.

The 'vira-cabeça' [top necrosis] of potatoes in Brazil [ibid., xviii, p. 338] appears to be identical with 'corcova'.

Chamberlain (E. E.). **Severe-streak of Tomatoes. A composite virus disease occurring in New Zealand.**—*N. Z. J. Sci. Tech.*, A, xxii, 4, pp. 181–186, 3 figs., 1940.

The tomato disease originally described under the name of severe streak [cf. *R.A.M.*, xix, p. 372] has now been found to be caused by a combination of tobacco mosaic and a necrotic virus [see next abstract]. After the first appearance of the disease in 1933, it remained in abeyance until 1938, when nearly 40 per cent. of a dwarf tomato crop covering $4\frac{1}{2}$ acres was infected by the double virus. Tobacco mosaic was also present alone to the extent of over 30 per cent., but the necrotic virus was only observed in conjunction with tobacco mosaic. In the 1939–40 season the two diseases were again present in the same garden, 25 per cent. of the crop being affected by tobacco mosaic but only a few plants showing the mixed virus.

Severe streak is readily communicable to tomato and tobacco by leaf-rubbing, every one of the plants of both hosts (Sutton's Best of All, Australian Dwarf, and Kondine tomatoes and Warne and Hickory Pryor tobacco) contracting the disease. Tobacco leaves develop brown, necrotic areas, $\frac{1}{16}$ in. or more in diameter, or ring spots consisting of a brown or pale, necrotic circle surrounding a small, necrotic spot. Secondary symptoms on older leaves assume the form of dark brown, necrotic lesions, often occurring as irregular circles or bands along the veins, while the young foliage shows severe interveinal necrosis, sometimes extending over the whole leaf, vein-clearing, later replaced by

mosaic mottling, and short, light brown, necrotic, superficial streaks; the diseased plants are much stunted.

Only the necrotic virus was recoverable from tree tomato (*Cyphomandra betacea*) plants inoculated with severe streak, though the plants developed mosaic mottling of the foliage, and severe streak symptoms were reproduced on tomato and tobacco with a combination of this virus with tobacco mosaic. It is thus apparent that the disease is due to a combination of the two viruses. The standard control measures for tobacco mosaic should also be effective against the necrotic virus, which is not in itself of economic importance.

CHAMBERLAIN (E. E.). **Tomato necrosis. A component of severe-streak of Tomatoes.**—*N.Z. J. Sci. Tech.*, A, xxii, 4, pp. 186–197, 5 figs., 1940.

The necrotic virus component of severe streak of tomato, separable from that of tobacco mosaic by passage through *Cyphomandra betacea* [see preceding abstract], produces on tomato leaves subcircular spots, $\frac{1}{16}$ in. in diameter, dark brown with paler centres. A few days later dark brown, necrotic bands develop along the veins, imparting a reticulate appearance, or small, dark, necrotic spots appear scattered over the leaf surface. In severe cases the lower and intermediate leaves tend to curl downwards and the plants are stunted.

The virus was transmitted by leaf-rubbing from tomato and tobacco to both hosts, from *C. betacea* to tobacco, from tomato and tobacco to *C. betacea*, from *C. betacea* and tobacco to *Datura stramonium* and *Physalis peruviana*, from tobacco to eggplant, *Nicotiana rustica*, and *N. glauca*, from tomato to Iron Duke potato and chilli, and from tobacco to *N. glutinosa*, and was transferred back from *C. betacea* to tomato and tobacco and from the other plants listed to tobacco. The symptoms on each of the artificially inoculated hosts are described.

The longevity of the virus *in vitro* exceeds 17 weeks; its dilution end-point lies between 1 in 500,000 and 1 in 1,000,000, and its thermal death point between 64° and 66° C. The virus does not agree with potato virus X, a common agent, in conjunction with tobacco mosaic, of tomato streak in other countries, or with any of the viruses of Solanaceous plants listed by K. M. Smith [*R.A.M.*, xvii, p. 52], and is therefore regarded as new.

CAMPBELL (W. A.) & DAVIDSON (R. W.). **Cankers and decay of Yellow Birch associated with Fomes igniarius var. laevigatus.**—*J. For.*, xxxix, 6, pp. 559–560, 1 fig., 1941.

*Fomes igniarius* var. *laevigatus* [*R.A.M.*, xv, p. 620] has been found associated with canker production and extensive decay of the trunks of yellow birches (*Betula lutea*) in the Adirondacks, Vermont, and Pennsylvania, the diameter of the affected trees usually ranging from 18 to 30 in. at breast height. On large trees the cankers formed depressions of appreciable extent to which the bark adhered firmly. The sterile mycelium impregnating the face of the canker was hard, black, superficially much cracked, brown and softer below. This brittle layer of bark and fungus varied between $\frac{1}{4}$ and $\frac{1}{2}$ in. in thickness and was closely appressed to the underlying wood. The number of cankers per

tree ranged from one to seven. In the present observations the thin, flat, brown, resupinate sporophores developed chiefly round the cankers on dead standing trees. Only one sporophore was detected by the writers on a living tree, but P. Spaulding and J. R. Hansbrough have a number of records of the occurrence of fruit bodies on living yellow birches. Eight yellow and eight black birches (*B. lenta*), 4 to 6 in. in diameter at breast height, were inoculated in August, 1936, with sterilized rye cultures of *F. igniarius* var. *laevigatus*, the average extent of the resultant decay in June, 1939, being 29 in. The presence of the fungus in the sapwood points to its potential capacity for vigorous attacks on living trees. It was reisolated from two of the seven trees in which the rot developed.

De Almeida (F. J.). **Safra e contra-safra na Oliveira.** [Production and counter-production in the Olive tree.]—[*Publ.*] *Minist. Agric., Lisboa*, Sér. Invest., 7, 154 pp., 44 figs., 6 graphs, 1940.

Included in this survey of the factors affecting olive production in Portugal is a very brief section on diseases as one of the causes of poor harvests, the organisms listed being *Rosellinia necatrix*, *Bacterium* [*Pseudomonas*] *savastanoi* [R.A.M., xx, p. 451], and *Antennaria elaeophila*, which diminishes photosynthetic activity by preventing the access of air and light to the foliar parenchyma, *Cycloconium oleaginum* [ibid., xix, p. 582], and *Gloeosporium olivarum* [ibid., xv, p. 521].

**Leaf scorch of Douglas Fir.**—*Gdnrs' Chron.*, Ser. 3, cx, 2845, p. 2, 1941.

Douglas fir trees [*Pseudotsuga taxifolia*] in England appear likely to suffer serious trouble from infection by *Rhabdocline pseudotsugae* [*R.A.M.*, xi, p. 82; xix, p. 248]. The disease is most dangerous in this country on the Blue Douglas and Intermediate or Fraser River varieties, while the Oregon variety sometimes shows slight burning. Trees of all ages are attacked, but nursery stock and trees up to 30 years of age suffer most. Individual trees have been observed to remain healthy when growing in affected nurseries, and these should be kept to form the final crop, and to produce seeds. All infected stock should be cut out, and the young stock in the nursery should be sprayed with Bordeaux mixture or lime-sulphur [ibid., xviii, p. 3].

Darlington (H. T.) & Culver (L. B.). **Keys to the species of Ribes occurring in the Great Lakes region.**—*Circ. Bull. Mich. agric. Exp. Sta.* 170, 23 pp., 12 figs., 1939.

Two keys are provided to the species of *Ribes* occurring in the Great Lakes region, one prepared on the characters noticeable during the dormant season and the other on those developing in the course of growth, and briefly designated 'winter' and 'summer' keys, respectively. One of the main objects of the classification is to assist phytopathologists in the determination of specific susceptibility to white pine blister rust (*Cronartium ribicola*) [*R.A.M.*, xx, p. 435].

Despeissis (J. L.). **A preliminary investigation of blue stain in 'kauvula' timber.**—*Agric. J. Fiji*, xii, 2, pp. 37–40, 1941.

Continuing his investigations into blue stain (associated under

Australian conditions with *Ceratostomella* spp.) of 'kauvula' (*Endospermum* spp.) timber in Fiji [*R.A.M.*, xx, p. 285], the author states that the dangerous period is while seasoning is in progress. Protection is afforded by rapid drying under conditions not favourable to fungal growth, or by dipping in borax solution [loc. cit.]. By controlling the temperature during kiln seasoning, it should be possible to render the borax treatment unnecessary.

Tests showed that a temperature of 130° F. at 100 per cent. relative humidity, if maintained for several hours, effectively sterilizes infected timber up to 4 by 4 in. in size, while 150° at 100 per cent. relative humidity for 9 hours effectively sterilizes timber up to 9 by 9 in. Air-dry timber is immune from attack by blue stain, and if infection is to be obviated, a temperature of 130° or over must be maintained until the moisture content falls below 20 per cent.

The author's investigations show three alternative methods of improving on the performance of the original kiln. The first is to improve the ventilation and maintain the temperature continuously above 130°; this should halve the seasoning period, and remove all danger of infection. It would, however, prove unduly expensive. The second, and most economical method at present, would be to continue the borax dip, and retain the kiln and the present working schedule. This gives a reasonable degree of freedom from infection and involves a minimum of additional expense. The third method remains to be tested. This is, to dry the timber first to below a moisture content of 20 per cent., thus destroying the fungi, and afterwards to steam it for the purpose of removing the odour. This method offers the possibility of saving the expense of the borax and of the labour used in dipping.

MOESZ (G. v.). **Die Pilze der Bergwerke und Höhlen in Ungarn.** [Mine and cave fungi in Hungary.]—*Bot. Közl.*, xxxviii, 1–2, pp. 4–11, 1941. [Hungarian, with German summary.]

Of the fungi collected in mines, caves, and cellars in Hungary, totalling 79, *Stereum hirsutum*, *Leptoporus fodinarum* (*Poria vaporaria* Auct. non Fries), *L. rufoflavus* (B. & C.) Pilát (syn. *L. braunii*), *Physisporinus vitraeus* (*Poria undata*), *Trametes* (*Lenzites*) *betulina*, and *T.* (*Polystictus*) *versicolor* were among the most common in the first-named habitat, while other species represented were *Coniophora cerebella* [*C. puteana*], *Merulius lacrymans*, *Poria vaillantii*, *T. quercina*, *Ganoderma lucidum*, *L. abietinus*, *Polyporus* [*Fomes*] *annosus*, *Armillaria mellea*, *Collybia velutipes*, *Lentinus lepideus*, and *Paxillus panuoides*.

LIESE (J.) & SCHUBERT (R.). **Beiträge zum Osmose-Verfahren.** [Contributions to the osmosis process.]—*Holz Roh- u. Werkstoff*, iv, 3, pp. 93–101, 4 figs., 10 graphs, 1941.

A tabulated account is given of the writers' laboratory and field experiments in 1939–40 at the Eberswalde (Germany) Forestry Institute to settle certain outstanding points in connexion with the osmotic method of timber preservation [*R.A.M.*, xix, p. 181]. It was ascertained in laboratory tests with an arsenic-containing U salt of the composition thanalith U, basilite UA, and osmol UA (paste 1 : 0·5) that the depth of penetration of sap-fresh pine sapwood depends on

the alignment of the xylem fibres, being much more extensive in the direction parallel with the fibres than radially, whilst penetration in the tangential direction was still less. With air-dried moistened sapwood the results were similar, but the penetration was not as great in the parallel and tangential directions, though greater in the radial. The addition of 5 per cent. colloid facilitated penetration at the beginning but checked it later on. In field experiments on sap-fresh pine, spruce, and beech (spruce wood felled at the end of December was shown in preliminary tests in 1934–5 to remain in a sap-fresh condition until the beginning of May), the three woods responded to penetration in the order named, the depth of infiltration (computed by means of a zircon oxychloride reagent) of the above-mentioned U salt into pine, spruce, and beech being 22, 20, and 19 mm., respectively, while the corresponding figures for a mixture of the foregoing and sodium fluoride (1 : 1) were 28, 25, and 23 mm., respectively, and for sodium fluoride alone, 30, 26, and 24 mm., respectively: the colloid adjuvant was incorporated with all the mixtures. The depth of infiltration of the protective salts depends on the sodium fluoride content of the mixture. In tests on air-dry pine and spruce wood fashioned into beams (12×14×80 cm.), planks (5×10×150 cm.), and boards (2·5×80 cm.) the following results were obtained. The pine boards (mostly sapwood) impregnated with the U salt mixture (without colloid) were found on inspection after four months to be completely permeated, whereas planks of the same wood (largely heartwood) were only partially infiltrated, the protective coating extending on all sides for a distance of 10 to 25 mm. but embracing the heartwood only down to 15 mm. Pine beams were similarly impregnated to a depth of 25 mm. of the sapwood, but only 5 to 10 mm. of the heartwood. Comparable data were secured in the spruce tests, the boards being for the most part fully infiltrated, while the depths of penetration into planks and beams were 6 to 25 and 10 to 15 mm., respectively.

A comparison of the osmosis values with those reported by workers in two other institutions in connexion with the application of an arsenical U salt to pine wood for the control of *Lenzites abietina* and *Coniophora cerebella* [*C. puteana*] by the Boucherie process [ibid., xix, p. 58], which gives depths of infiltration ranging from 33 to 70 mm., demonstrates the superiority of the latter method from this point of view. Osmosis, however, possesses certain advantages, notably simplicity, independence of a copious water supply, and applicability to felled wood *in situ*, which eminently fit it for silvicultural uses, more especially in the tropics.

Green (D. E.). **Hygiene in the war-time vegetable garden. VI, VII, & VIII.**—*J. R. hort. Soc.*, lxvi, 6, pp. 210–214, 4 figs. (between pp. xlvi and xlvii); 7, pp. 251–255, 3 figs.; 8, pp. 290–294, 4 figs., 1941.

Continuing his earlier papers in this series [*R.A.M.*, xx, p. 324] the author gives short popular notes on the symptoms and control of the chief fungous, virus, and non-parasitic diseases of tomatoes and vegetables in England.

Larson (R. H.) & Walker (J. C.). **Ring necrosis of Cabbage.**—*J. agric. Res.*, lxii, 8, pp. 475–491, 12 figs., 1941.

A virus disease of cabbage observed in 1937 at Madison, Wisconsin, is described under the name of ring necrosis. It resembles in several respects the viruses of black ring [*R.A.M.*, xvii, p. 151] and ring spot [ibid., xiv, p. 669] of cabbage, but it is distinguished from them by physical properties, host range, and symptoms on the common hosts. One of the major differences between ring necrosis and black ring is the masking of the former at 13° to 19° C. On cabbage growing at 22° to 25° no symptoms appear on inoculated leaves, but 17 to 21 days after inoculation small, yellow lesions appear on the fourth or fifth unfolded leaf. The lesions increase in size and number and become necrotic in the centre; later necrotic concentric rings develop, giving a bull's-eye spot in which the dead tissue is brown or blue black. The tissue between the lesions becomes dry and brittle and the leaves drop prematurely. Necrosis may also develop on or along the veins. The ring necrosis virus infected all the 25 species and subspecies of crucifers tested and also sugar beet, Swiss chard (*Beta vulgaris* var. *cicla*), spinach, tobacco, *Nicotiana glutinosa*, *N. langsdorffii*, *N. rustica*, *N. repanda*, *Petunia*, *Zinnia*, and *Calendula*. It was transmitted by mechanical inoculation and through the aphids *Myzus persicae* and *Brevicoryne brassicae*. *In vitro* the virus remained infective after 36 but not 48 hours' ageing at 20° to 22° C., it was inactivated by ten minutes' heating at 50° but not at 48°, and tolerated dilution to 1 in 500 but not to 1 in 600.

Stubbs (L. L.). **Some diseases of Cabbages and Cauliflowers.**—*J. Dep. Agric. Vict.*, xxxix, 5, pp. 208–212, 5 figs., 1941.

Short, popular notes are given on the symptoms, causes, and control of the chief diseases of cabbages and cauliflowers in Victoria. Against blackleg (*Phoma lingam*) it is important to adopt preventive measures [*R.A.M.*, xi, p. 489] comprising the use of clean seed from healthy plants, clean soil for the seed-bed, rotation with non-cruciferous crops, furrow irrigation, and seed disinfection with mercuric chloride (30 minutes in 1 in 1,000 solution). In America, hot water treatment (122° F. for 15 to 30 minutes) is claimed to have given complete disinfection, but germination may be impaired.

Against club root (*Plasmodiophora brassicae*) [ibid., xix, p. 356] control methods are very difficult. The growing of cruciferous crops in infected soil should, if possible, be abandoned. If this is impracticable, a rotation of at least four years should be practised. Heavy liming (one to two tons per acre of agricultural lime, applied several months before planting, are tentatively recommended) will suppress infection, but, if potatoes are included in the rotation, will favour scab (*Actinomyces scabies*). In the United States, J. C. Walker (*Fmrs' Bull. U.S. Dep. Agric.* 1439, 1938) has recommended keeping the soil uniformly moist during the growing period to enable the lime to neutralize acidity round the roots. In England and New Zealand treatment with mercuric chloride is recommended [*R.A.M.*, xiv, pp. 2, 278].

Cauliflower whiptail is widely prevalent on acid soils in Victoria, where successful control has followed liming [ibid., xiii, p. 344].

Leach (L. D.). **Root-rot diseases of Sugar Beets in California.**—*Sug. Bull., N.O.*, v, 2, pp. 56–57, 1941. [Abs. in *Sugar* (formerly *Facts ab. Sug.*), xxxvi, 7, p. 43, 1941.]

The most important root rots of sugar beet in California are southern *Sclerotium* rot [*S. rolfsii*: *R.A.M.*, xviii, p. 76], dry rot canker (*Rhizoctonia* [*Corticium*] *solani*) [ibid., xx, p. 391], charcoal rot, and wet (*Phytophthora*) root rot, especially the two first-named. The soil population of *S. rolfsii* can be reduced to a safe level in two to four years by rotation with cereals or winter crops, such as peas, spinach, or lettuce, whereas beans [*Phaseolus vulgaris*], both on account of their susceptibility to the pathogen and their cultivation during the summer at the high temperatures favouring its growth, contribute to the maintenance or increase of the fungus. Infection may be reduced by one-half by the application of a commercial fertilizer containing 100 lb. nitrogen [per acre].

The control of *C. solani* is complicated by the existence of physiologic races of the fungus attacking a variety of crops. Beans and potatoes at any rate should be excluded from the rotation with sugar beets.

Свекловодство. I. Биология, генетика и селекция Сахарной Свеклы [Sugar Beet growing. I. Biology, genetics, and selection of Sugar Beet.]—918 pp., 306 figs., 12 diags., 34 graphs, 11 maps, Kieff, Госуд. Издат. колх.-совх. Литер. У.С.С.Р. [State Publ. Off. Lit. collect. co-op. Farming Ukrainian S.S.R.], 1940.

This volume on the biology, genetics, and selection of sugar beet issued by the Pan-Soviet Scientific Research Institute for Sugar Industry (VNIS) contains one chapter on the selection of sugar beet for resistance to fungous diseases by V. N. Shevtchenko (pp. 787–794), in which Russian and foreign work on the subject is critically reviewed.

Omeltchouk (A. V.). Влияние заражения почвы грибом **Trichoderma lignorum** на урожай Сахарной Свеклы и изменение почвенных процессов. [The effect of the infection of soil with the fungus *Trichoderma lignorum* on the yield of Sugar Beet and changes in soil processes.]—Научн. зап. по Сахарн. Пром. [*Sci. Notes Sug. Ind.*], Kieff, [Grey Ser.], xvii, 1–2, pp. 119–121, 1940.

The results of field experiments conducted by the VNIS [Pan-Soviet Scientific Research Institute for Sugar Industry] showed that inoculation of the soil in spring and autumn with *Trichoderma lignorum* [*T. viride*: *R.A.M.*, xix, p. 381; xx, p. 322; and above, pp. 491, 492], *Aspergillus niger*, and *Azotobacter* led to an increase in the water content of the soil, which could be utilized by the sugar beet during the dry periods of the year. Moreover, it facilitated the assimilation of nutritive elements from the soil and increased the yield, the maximum increases resulting from the inoculation of soil with *T. viride* and *A. niger*, with or without *Azotobacter*.

Townsend (G. R.). **Diseases of Beans in southern Florida.**—*Bull. Fla agric. Exp. Sta.* 336, 60 pp., 11 figs., 2 graphs, 1939. [Received August, 1941.]

Popular descriptions are given of a number of well-known bean

[*Phaseolus vulgaris*] diseases in southern Florida, with discussions of the factors involved in their occurrence and directions for control by cultural practices and direct fungicidal treatments.

BREMER (A.). **Beobachtungen quantitativer Art über das Auftreten von Schäden an Gemüsepflanzen auf dem Versuchsfelde der Zweigstelle Aschersleben der Biologischen Reichsanstalt für Land- und Forstwirtschaft während der Jahre 1929 bis 1935. 3. Mitteilung.** [Observations of a quantitative character on the occurrence of injuries to vegetable plants on the experimental field of the Aschersleben branch of the Biological Institute for Agriculture and Forestry during the years 1929 to 1935. Note 3.]—*Z. PflKrankh.*, l, 12, pp. 577–595, 1 fig., 3 graphs, 1940.

Some 40 per cent. of a pea seed sample tested in the laboratory at the Aschersleben [Saxony] branch of the Biological Institute in 1935, were found to be infected by *Ascochyta pisi* [*R.A.M.*, xix, p. 510], giving a proportion of emergence ranging from 23 to 62 per cent. compared with 84 to 100 per cent. (with the exception of one July-sown batch which gave 48 per cent. only) for healthy material. As was to be expected, emergence in both the healthy and diseased samples was best in April and May, falling off in the summer with rising temperatures and declining rainfall. In 1934, out of 102 samples tested the number with no pod infection was 78, those with pod infections of 1 to 10 per cent. numbered 20, and of 11 to 20, 21 to 30, and 31 to 40 per cent., 2, 1, and 1, respectively; in 1935, out of 226 samples tested, 135 showed no pod infection, 51 showed 1 to 10 per cent., while there were 13, 14, 3, 2, 6, and 2 with 11 to 20, 21 to 30, 31 to 40, 41 to 50, 51 to 75, and 76 to 100 per cent., respectively. The total numbers of pods involved in 1934 and 1935 were 6,661 and 13,161, respectively, of which 132 (2 per cent.) and 853 (6·5 per cent.), respectively, were diseased. Among the most resistant varieties, judged by the incidence of pod infection in 1935, were Verbesserte Vorbote, Allerfrüheste Mai, Buraus Doppelschotig, Flügel, Senator, Grünbleibende Folger, Wonder of Witham, and Ruhm von Quedlinburg, while a high degree of susceptibility was shown by Grünrock, Saxa, Mahndorfer, Peragis (field), and Schladener.

Pea rust (*Uromyces pisi*) and mildew (*Erysiphe polygoni*), in contrast to *A. pisi*, are not seed-borne but perpetuated in the vicinity of the fields, and hence are predominantly associated with the maturity of the host. In none of the years covered by the observations was the conspicuous aecidial stage of *U. pisi* absent from *Euphorbia cyparissias* [ibid., xi, p. 760], while the Erysiphaceae are well known to be capable of infecting their hosts at all times and in any place given favourable conditions and a sufficient degree of susceptibility. In general, the susceptibility of the leaves of Express Vorbote peas was found in 1934 and 1935 to increase with age. An important difference between the two pathogens lies in the duration of their activity, the rust commencing earlier than the mildew but dying out in September, whereas the latter persisted right through October.

*E. cichoracearum*, the agent of cucumber mildew, which is economically the most important disease of the crop in central Germany

[ibid., xix, p. 489], develops practically every year, the earliest date of observation at Aschersleben in 1930 being 18th July (100 per cent. infection a week later), in 1932 25th July (a season of mild attacks), in 1933 11th July, and in 1935 20th July. Data are presented showing that *E. cichoracearum* is liable to develop during a wet period after the cucumbers have reached a certain age and developed a sufficiency of foliage (about 10th July locally), and to be arrested by an ensuing dry spell. It is therefore advisable to treat the crops with sulphur between 10th July and 15th August.

Scab (*Cladosporium cucumerinum*) [ibid., xviii, p. 651] was particularly severe in central Germany in 1930 and 1932, reducing the harvest to a substantial extent. On the Aschersleben experimental field the disease occurred only in 1932, a count made on 7th October showing 197 out of 1,119 fruits infected (17·6 per cent.); the incidence was about twice as heavy (22·9 per cent.) on a plot receiving stable manure as on one not so treated (11·6 per cent.).

A hitherto unidentified species of *Verticillium* caused such heavy annual depredations as largely to invalidate the manuring and mildew control experiments until 1935, when it was suppressed by growing the seedlings in sterilized flower pots, in which they were subsequently transplanted.

Bremer (H.). **Beobachtungen quantitativer Art über das Auftreten von Schäden an Gemüsepflanzen auf dem Versuchsfelde der Zweigstelle Aschersleben der Biologischen Reichsanstalt für Land- und Forstwirtschaft während der Jahre 1929 bis 1935. 2. Mitteilung. Schäden an Spargel und Möhren.** [Observations of a quantitative character on the occurrence of injuries to vegetable plants on the experimental field of the Aschersleben branch of the Biological Institute for Agriculture and Forestry during the years 1929 to 1935. Note 2. Injuries to Asparagus and Carrots.]—*Z. PflKrankh.*, 1, 8, pp. 402–412, 4 graphs, 1940.

This further instalment [cf. preceding abstract] of the writer's observations on the occurrence of injuries to the vegetable crops grown at the Aschersleben [Saxony] branch of the Biological Institute from 1929 to 1935 deals mainly with insect pests [*R.A.M.*, xix, p. 508], but a brief note on asparagus rust (*Puccinia asparagi*) states that the disease, conveyed to the newly laid down plots of the experimental field by teleutospores, developed year after year in a fairly severe form. Gassner and Hassebrauk have shown [ibid., xiii, p. 677] that young plantings are essential to the initiation of rust epidemics in the commercial stands, and this condition was consistently fulfilled during the period of the investigations. The importance of primary infection for the subsequent course of the disease was clearly attested in 1935, when heavy infection by pycnidia, aecidia, uredo-, and teleutospores was transmitted to a plot through dry, rusted straw.

El-Helaly (A. F.). **The effect of Rhizoctonia solani Kühn on the germination of Lettuce seed at somewhat high temperatures.**—*Proc. Linn. Soc. Lond., 1939–40*, Session 152, Pt 1, 1940.

Experiments [which are fully described] made to ascertain why the

presence of *Rhizoctonia* [*Corticium*] *solani* in autoclaved soil increased the percentage germination of lettuce seed at temperatures ranging from 25° to 30° C. gave the following data. Within this range of temperature a certain percentage of viable lettuce seeds remains dormant. If the temperature is reduced below this range, germination of the remainder up to the theoretical amount (80 to 90 per cent.) takes place at once. The treatment does not injure the seeds, but inhibits germination. The percentage of dormant seeds is lower on weak than on strong media, and the presence of the fungus in the latter increases germination. The stimulation due to the fungus appears to be unrelated to the setting-up of any particular $P_H$ value in the medium. It was not found possible to replace the fungus by metabolic products, but on the other hand no fungal penetration of the seed was observed. Some evidence was obtained that other fungi may have a similar effect on germination.

It would appear that the dormancy of lettuce seed at the temperatures mentioned can be overcome to some extent by exposure to carbon dioxide (optimum, 2 to 5 per cent.). The same result follows from the addition to the substratum of any fungus able to produce a favourable concentration of carbon dioxide round the seeds, while liberating no deleterious products.

PONTIS (R. E.). **La 'viruela' del Apio en la Provincia de Mendoza.** [Celery 'pox' in the Province of Mendoza.]—*Bol. agríc., Mendoza,* ix, 1–3, pp. 54–56, 1 fig., 1941.

A popular account is given of celery blight (*Septoria apii-graveolentis*) as it occurs in the Province of Mendoza, Argentine Republic [*R.A.M.*, xvii, p. 498], with directions for its control.

LAMBERT (E. B.). **Studies on the preparation of Mushroom compost.**—*J. agric. Res.*, lxii, 7, pp. 415–422, 1 fig., 1 diag., 1 graph, 1941.

In studying the effect of conditions prevailing in different areas of the compost heap on the growth of mushroom [*Psalliota* spp.] mycelium in the compost [*R.A.M.*, xx, p. 105], selected samples of compost were inoculated with mushroom spawn and incubated at 70° F. in competition with the weed moulds present in the compost. Under aerobic conditions fermentation at temperatures between 120° and 140° for 8 to 10 days produced suitable compost, while temperatures over 150° for a few hours rendered the compost unsuitable. Anaerobic fermentation produced unsuitable composts even at favourable temperatures. Under alternating composting conditions the compost tended to assume characteristics typical of the last environment to which it was subjected. Thus, a compost made unsuitable by adverse environmental conditions can again become suitable when exposed to aerobic fermentation at moderately high temperatures. It was shown in these studies that the usual method of composting in outdoor heaps results in different rates of decomposition in different layers of the heaps, and is not an efficient procedure. Under favourable conditions, in bottles, fresh manure can be converted into compost in about one-third the time required in the heap. The sweating-out period is the only part of the composting process during which nearly all of the manure is

fermenting under favourable conditions, and being the last environment to which the manure is subjected before spawning, close control of the conditions during this period is essential.

GLASSCOCK (H. H.) & WARE (W. M.). **Investigations on the invasion of Mushroom beds by Pseudobalsamia microspora.**—*Ann. appl. Biol.*, xxviii, 2, pp. 85–90, 1 fig., 1941.

Since *Pseudobalsamia microspora* [*R.A.M.*, xviii, p. 295] was first recorded in mushroom (*Psalliota* spp.) beds in England in 1936, the authors have investigated five cases of its occurrence in this country, in three of which it was isolated directly from the soil, while in the other two circumstantial evidence suggested its introduction with the casing soil.

A simple method of testing soil for the presence of the fungus consists in packing into the lower half of a glass boiling-tube fresh pure-culture spawn of the white cultivated mushroom, slightly moistened. This is covered with a layer of about ½ in. of the (moistened) soil to be tested. The tube is plugged with cotton wool and placed in an incubator kept at 83° F. If the soil is infected, a cottony growth of cream-coloured mycelium fills the matrix of the spawn and the soil itself after about a fortnight. A few days later, ascocarps develop freely on the soil surface and throughout the contents of the tube. Six tubes are enough for each sample.

The available evidence indicates that prevention consists in avoiding the use of contaminated casing soil. In some cases, complete control results if the infected parts of the bed are removed promptly and the sites disinfected. As the fungus was found by the authors to withstand a temperature of 180° for four hours, its elimination by heat during composting or the peak period before spawning is unlikely, while steam sterilization of the casing soil would not be certainly effective. The fungus grows best at 83°, and if its presence is suspected the crop should be grown at the lowest temperature consistent with good practice. In the absence of favourable conditions for ascocarp development on the surface of the casing soil, the invader may develop in a bed without any external signs of its presence, and some of the crop failures of the past may thus be accounted for.

PARRIS (G. K.). **Diseases of Taro in Hawaii.**—*Circ. Hawaii agric. Exp. Sta.* 18, 29 pp., 5 figs., 1941.

The symptomatology, etiology, and control of the following taro (*Colocasia esculenta*) diseases in Hawaii are described. *Pythium* root rot [*R.A.M.*, xviii, p. 657] is responsible for reductions ranging from 10 to 100 per cent. of the crop; at a conservative estimate of 25 per cent. this represents a loss of $50 to 75 per acre. The rot usually originates at the base of the corm, which turns whitish-yellow to grey, blue, or dark purple and may assume a parallel-sided or bottle-necked shape in contrast to the normal ovoid or oblong. The pathogen persists in the soil on the refuse left on the ground after harvesting, and is favoured by high atmospheric and soil temperatures, the latter being largely determined by the distance of the irrigation water from its origin on the mountain ridges 2,000 to 6,000 ft. above soil-level, where

it is 4° to 6° F. colder than at the middle or mouth of the valleys. Of the wet-land varieties commonly grown in Hawaii, Piialii is more susceptible than Piko Uliuli, while Kai Kea and Kai Uliuli are quite resistant. Thorough ploughing and drying of the soil and the exclusion of *C. esculenta* from the crop rotation for a period of six months to a year are the best means of control, which have not so far been equalled by any chemical soil treatment, though lime at the rate of 2 to 4 tons per acre is being used by some growers with beneficial results.

Hard rot of obscure origin, and also known locally as 'guava seed' or 'black and white' disease [ibid., xvi, p. 301], is responsible for substantial losses, ranging from 5 to 100, with an average of 30, per cent., representing a financial depreciation of $60 to 80 per acre, especially in the susceptible Piko Uliuli variety. The rotted, woody, pale yellow or dirty brown tissues are usually situated in the lower third or centre of the corm, or in a number of localized hardened areas distributed all through it. The disease destroys the vascular system of the corm from the peripheral root traces inwards; the skin is of a bark-like consistency, $\frac{1}{8}$ to $\frac{1}{4}$ in. thick, deeply furrowed, friable, and coarse, dirty white to purplish, with retracted, often deeply sunken buds. The removal of the small internal lesions leaves a clean-cut, smooth, circular hole ('guava seed'), but in severe cases the entire corm is reduced to a brown or black skeletal framework. Dark-ringed 'huli' (the native name for planting material consisting of $\frac{1}{8}$ to $\frac{1}{4}$ in. of the apex of a corm with one or more buds) taken from diseased corms have been found to give rise to hard rot in the progeny, while the use of affected suckers for planting leads to similar results. In preliminary tests the dipping of the lower ends of the 'huli' in 1 : 1 : 3 Bordeaux paste gave promising results. A comparison of the stands raised from healthy and diseased planting material revealed an incidence of 40 and 70 per cent. hard rot, respectively, the disorder being more prevalent in steam-sterilized infected soil than in an unsterilized field plot. Hard rot has been observed in a severe form on land previously under *Panicum purpurascens* for upwards of five years, and may be associated with a low water-table or inadequate irrigation of the plants from the age of eight to nine months onwards. The application of lime to the soil at the rate of 2 tons per acre considerably reduced hard rot in two localities, but cannot be unreservedly recommended. Taros of the Kai group appears to possess resistance to both hard and *Pythium* rots, and may provide material for breeding experiments.

The so-called 'loliloli' (water-soaked or punky) disease, characterized by softness of the corms, which exude water and are deficient in starch, is believed to be due to the withdrawal of the latter by the leaves, a natural process sometimes deliberately stimulated by growers, to delay the ripening of the corms for economic reasons, by the application of sodium nitrate to the plants when approaching maturity. Suckers from *Pythium*-rotted plants that put out new leaves and develop individual root systems are also liable to produce water-soaked corms.

*Sclerotium rolfsii* causes stunting of the plants and an ochreous to brown, soft, somewhat stringy rot of the corms of upland taro, especially in over-mature or poorly irrigated stands. The ploughing-under of

infested soil to a depth of 4 to 8 in. should reduce the losses from this disease. Infected plants and the surrounding soil should be burnt, and timely harvesting is advocated.

None of the 32 varieties tested showed resistance to the destructive leaf spot caused by *Phytophthora colocasiae* [ibid., xvii, p. 731; xviii, p. 505; xix, p. 514], a conservative estimate for the average loss from which is 25 per cent. When dry, the clear, yellowish to amber-coloured liquid oozing from the dark, yellow-bordered lesions, 1 to 2 cm. in diameter, turns bright yellow or dark purple. Under humid conditions the sporangia composing the whitish efflorescence on both sides of the spots germinate on the healthy leaves, on to which they are blown by wind or splashed by rain, in three to five days. Spraying with 4–4–50 Bordeaux mixture plus a spreader at 10- to 17-day intervals has given effective control and raised the yields on Oahu by 10 to 30 per cent., while wide interspacing of the plants (at least 16 to 18 in.) is also a help in the elimination of the fungus.

*Phyllosticta colocasiophila* [ibid., xvii, p. 731] produces oval to irregular, buff-coloured, later dark brown, marginally zonate spots, $\frac{1}{4}$ to 1 in. or more across, on both leaf surfaces; the diseased areas decay and the centres frequently drop out. Heavy losses may arise from this source in upland taro, only one of the 27 varieties of which tested, Manini Uliuli, proved resistant. Infected material should be burnt, but spraying should only be resorted to in persistent cases of heavy defoliation.

A species of *Cladosporium* produces dark brown, diffuse spots, up to 5 or 10 mm. in diameter, on the leaves of upland varieties, especially the Japanese Tsurunoko, without, however, causing perceptible damage.

LUTHRA (J. C.) & SATTAR (A.). **Control of Gram blight in the Punjab.**—*Indian Fmg*, ii, 2, pp. 66–69, 2 pl., 1941.

Following a summary of the economic importance, symptoms, and mode of perpetuation of gram (*Cicer arietinum*) blight (*Mycosphaerella rabiei*) [*R.A.M.*, xv, p. 700] the writers describe the control measures which have been in progress against the disease for several years past at the Agricultural Farm, Campbellpur, Punjab, with special reference to the performance of resistant varieties, notably F8 [ibid., xviii, p. 86]. The average yield of this strain, 13 maunds [1 maund = 82·284 lb.] per acre, in tracts of widespread devastation from the disease, compares favourably with that of the leading Punjab types 7 and 15. The total output from the area of 2,086 acres planted with F8 seed in 1939 amounted to 22,032 maunds, with an average yield of $10\frac{1}{2}$ maunds per acre. The discovery of this type is regarded as an important contribution to the development of disease-resistant strains of Indian farm crops, and seed has been issued to the public for replacement of the local type, especially in districts where the blight has long been epidemic.

WATANABE (T.). **On the influence of hydrogen-ion concentration on the development of the atrophic fire-blight disease of the Udo Salad plant.**—*Ann. phytopath. Soc. Japan*, x, 2–3, pp. 186–191, 1940. [Japanese, with English summary.]

No relationship could be discerned between the hydrogen-ion con-

centration of the stems and leaves of Udo salad (*Aralia cordata*) and other Araliaceae and the development of atrophic fireblight (*Phoma araliae* var. *microspora*) [*R.A.M.*, xviii, p. 434], to which varieties and strains of the Kan-Udo group are susceptible and those of Haru-Udo resistant.

OSTERWALDER (A.). **Ein oder zwei Bespritzungen vor der Rebblüte?** [One or two sprays before Vine blossoming?]—*Schweiz. Z. Obst- u. Weinb.*, l, 12, pp. 265–269, 1941.

The writer reverts to the question of the number of sprays to be applied to vines in the Zürich district of Switzerland for protection against *Peronospora* [*Plasmopara viticola*: *R.A.M.*, xix, p. 325; cf. also xx, pp. 289, 391]. During the last 20 years, the first spots have been observed 15 times between 9th June and 1st July, the earliest outbreak having taken place on 1st June. Reckoning the period elapsing between the first and second outbreaks as 10 to 14 days, the first treatment need not be given before the middle of June. In 12 out of the 20 years covered by the observations, the vines blossomed after mid-June, in which case, supposing the initial attack to have developed about the 1st, and flowering to be delayed until the end of June or early July, two applications would be necessary, one in the middle of the month and another towards the end. Generally speaking, however, one application shortly before blossoming should suffice, entailing a total of four treatments during the season (five in exceptional years), viz., one (possibly two) before flowering, one post-blossom, and two more at 10- to 14-day intervals.

The reduced number of primary downy mildew infections in recent seasons, as compared with former years, attributable largely to more effective spraying of the lower leaf surfaces, is a further reason for the postponement of the initial treatment. In the autumn of 1940, not many old leaves bore fungal lesions, and these contained few oospores; spots were present, for instance, only in 4 out of 36 leaves of the Riesling × Sylvaner variety and 6 in 28 leaves of Blue Burgundy, while none were present in 12 of Räuschling.

These recommendations do not apply to districts in which roter Brenner [*Pseudopeziza tracheiphila*] is rife, two pre-blossom treatments being essential for the control of this fungus. The overwintered spores are discharged by the end of May or early June, necessitating a preventive application on or after 20th May, followed by the routine downy mildew spray in mid June. In the environs of Zürich, where *P. tracheiphila* at one time assumed a devastating character, the disease has latterly become a rarity thanks to the regular late May treatment.

SCOTT (L. E.). **An instance of boron deficiency in the Grape under field conditions.**—*Proc. Amer. Soc. hort. Sci.*, xxxviii, pp. 375–378, 1941.

In June, 1939, vines growing on Norfolk sand near Columbia, South Carolina, developed symptoms indicating boron deficiency. The leaves showed a well-developed pattern, with chlorotic areas towards the margin and between the veins. The leaf surface was rough, with raised areas between the veins, which resulted in cupping towards the under side. Some of the more severely affected vines, especially the Ontario

variety, showed an unusual development of lateral buds on the current season's shoots.

On 22nd June, 1939, a few affected vines of 10 varieties were treated with commercial borax at the rate of 10 lb. per acre, applied to the soil on either side of the vine. In July and August, the new growth was observed to be normal. The late growth on untreated vines showed little abnormality.

In May, 1940, a number of varieties untreated in 1939 showed pronounced dwarfing, with the development of several shoots from a single node, and the initiation of lateral bud growth on the short, stunted shoots. The internodes were very short and the leaves small. Flower clusters developed very conspicuously on these shoots, but were twisted, malformed, and abortive, and failed to set fruit. Applications of borax on 22nd May resulted in normal growth by 8th July, while the abnormal symptoms continued to appear on untreated vines.

The yields given in 1940 by the vines treated with borax in 1939 were 15, 2·8, 9·4, 41·8, and 5 lb. per vine (average of two to five vines) for the Catawha, Delaware, Extra, Lenoir, and Concord varieties, respectively, the corresponding figures for the untreated vines being 1·4, 0, 5·2, 2·5, and 1·3 lb., respectively.

Marked differences were noted in varietal reaction to the deficiency. The weaker varieties, such as Delaware, Ontario, and President were mostly more severely affected than the rank ones, such as R. W. Munson, Bailey, and Champion. Susceptible varieties, when grafted on vigorous rootstocks, remained unaffected.

BRYANT (L. R.) & BEACH (G. A.). **A preliminary study of chlorosis in American Grapes.**—*Proc. Amer. Soc. hort. Sci.*, xxxviii, pp. 395–396, 1941.

A list is given showing the degree of susceptibility to iron-deficiency chlorosis [*R.A.M.*, xx, p. 101] observed during a period of three years in 42 vine varieties grown at Fort Collins, Colorado, the most resistant group comprising Beta, Brighton, Delaware, Eaton, Elvira, Herbert, Portland, Salem, and Urbana. Champagne, Pocklington, and Lutie showed severe symptoms.

NEERGAARD (P.). **5. Aarsberetning fra J. E. Ohlsens Enkes Plantepatologiste Laboratorium 1 April 1939–31 Marts 1940.** [Fifth annual report of the phytopathological laboratory of J. E. Ohlsen's widow from 1st April, 1939, to 31st March, 1940.]—14 pp., 1940. [English and Esperanto summaries.]

This report [cf. *R.A.M.*, xviii, p. 572] gives details of the incidence of numerous pathogenic fungi in the 4,299 samples of vegetable seeds examined during 1939–40. The following are new disease records for Denmark: *Botrytis byssoidea* [ibid., xviii, p. 430] on leeks; *Colletotrichum circinans* on onions; *Dendryphium penicillatum* [*Pleospora calvescens*: ibid., xv, p. 743] on seeds of *Papaver nudicaule*; *Ascochyta cucumis* on cucumber; *A. asteris* on seeds of *Callistephus chinensis* [ibid., x, p. 734], the spores of the fungus measuring 6 to 9 by 2·3 to 4·5 (average 7·3 by 3·4) $\mu$; *Alternaria dianthi* on nine flowering varieties and seed of carnation [ibid., xii, p. 707]; and *A. circinans* on *Iberis amara* var. *coronaria*

(Empress) and *I. umbellata* (vars. *lilacina* and Rose Cardinal), these being apparently new hosts for the pathogen in question.

WATERS (H. B.). **Report on the Department of Agriculture, Gold Coast, for the year 1940–41.**—10 pp., 1941.

In this report [cf. *R.A.M.*, xix, p. 261] it is stated that the cacao shade tree-planting scheme, though of less importance now that swollen shoot has been ascertained to be of virus origin [ibid., xx, p. 452], is being continued in those areas of the Gold Coast where die-back [ibid., xix, p. 390] is present, and on inadequately shaded farms.

Steps taken to control swollen shoot are as follows. A survey was made of all cacao areas near the localities where the main outbreaks have occurred to determine to what extent infection has spread. Diseased patches isolated from the chief infection centres were treated. The introduction of planting material from affected localities into healthy areas was forbidden. Finally, it was decided to establish, if necessary, zones free from cacao, to prevent the spread of the disease. It is as yet too soon to express an opinion on the effect of these measures, but infection has not reappeared in some localities treated six months ago. The surveys are providing valuable data. Twenty-six lots of planting material were prevented at gate checks on the roads from entering healthy areas. In the principal centre of infection, which covers about 400 sq. miles, direct control is already impracticable.

In the Eastern Province all nurseries laid down during past years under the cacao rejuvenation campaign were maintained, and an adequate supply of shade tree seedlings is now available in all districts. Early in the period under review, preliminary surveys were made in the Krobo, Kibi, and Kwahu districts, and up to November detailed, systematic surveys were started in the same districts and continued until the end of March, 1941. Two slight outbreaks of swollen shoot at Bunsu and a more extensive one at Kwabeng were treated by cutting out all the infected cacao together with a ring of apparently healthy trees, and spraying before and after the operation with nicotine solution. Compensation was paid to farmers for the apparently healthy trees destroyed. The somewhat extensive area isolated at Awenade was also surveyed and is first on the list for treatment. Evidence was obtained which indicated that drastic action will successfully eradicate the disease at Tafo.

A new disease of cacao, termed 'warty pod', is under investigation.

The campaign against banana Panama disease [*Fusarium oxysporum* var. *cubense*: ibid., xx, p. 342] is being actively pursued; the infection sites are still contained in the Tetrim-Nsuaem area, while there are a few infections at Abra; the northern areas are unaffected.

Very satisfactory progress has been achieved in the production of high-yielding cassava strains resistant to mosaic [ibid., xx, p. 102], and it has now become possible to recommend varieties for particular areas. Among the strains and varieties which have been thoroughly tested, the outstanding ones have been named Queen, Garri, and Sareso; the first two are suitable for the forest area, while the third is best for the northern territories.

**Forty-sixth and forty-seventh Annual Reports of the Montana Agricultural Experiment Station July 1, 1938 to June 30, 1940.**—65 pp., 1 map, [? 1940.]

These reports comprise a number of items of phytopathological interest, including notes on cereal diseases by A. H. Post (pp. 12–14), sugar beet diseases by H. E. Morris (pp. 20–22), and on insect transmission of bean [*Phaseolus vulgaris*] diseases by H. B. Mills (pp. 27–28). Thatcher and Pilot were recommended in 1939 as standard wheat varieties for regions of Montana where stem rust [*Puccinia graminis*] constitutes a serious problem. Pilot, produced co-operatively by the United States Department of Agriculture and the Montana, Minnesota, and North and South Dakota Agricultural Experiment Stations, is a bearded spring wheat equal to Marquis in yield, very resistant to rust, and satisfactory for milling and baking purposes.

Dwarf smut of wheat [*Tilletia caries*], recently detected in the Gallatin Valley and also occurring to a limited extent in Utah, Idaho, and Washington [*R.A.M.*, xviii, p. 441], is regarded as much more serious than ordinary bunt owing to its resistance to existing methods of seed-grain treatment. Some of the 100 varieties grown in the infested area with a view to the selection of resistant types gave very promising results and will be further tested.

A strain of oats derived from a cross between Markton and Victory has been found to combine resistance to smut [*Ustilago levis* and *U. kolleri*: see below, p. 525] and halo blight [*Bact. coronafaciens*] with other desirable commercial qualities.

During the past four years, data have been recorded on phosphate deficiency and *Fusarium* wilt in beet seedlings. All rotations with lucerne resulted in extensive seedling decay and phosphate deficiency, especially where beets immediately followed the fodder crop and manure was withheld. Wilt occurs chiefly in continuous cropping and in one-, two-, and three-year rotations, particularly on light soils.

Bean mosaic has been found to be most prevalent in plantings adjoining lucerne and sweet clover [*Melilotus*] stands, which may harbour the virus and its insect vectors. Susceptible varieties, even though carrying no infection in the seed, may rapidly contract mosaic in proximity to the fodder crops, with a consequent decrease in yield. Within the Great Northern variety, two Idaho selections and one from Montana remained free from the disease during two years' experimental exposure to insects conveying infection from commercial seed sources.

**Plant diseases.**—*Rep. Wis. agric. Exp. Sta., 1939–40*, Part II (*Bull.* 451), pp. 52–70, 5 figs., 1941.

This report on plant disease work in Wisconsin in 1939–40 [cf. *R.A.M.*, xvii, p. 656] contains the following items of interest, apart from those already noticed from other sources. Evidence was obtained by J. C. Walker and J. P. Jolivette that local crops which may show boron deficiency include garden beets, cabbage, cauliflower, rutabaga, and sugar beet [ibid., xvii, p. 506]. Tests indicated that on a soil sufficiently lacking in boron to cause severe heart rot of sugar beets, one application

of borax at the rate of 20 lb. per acre can be expected to afford protection for two years, while one at double or treble this rate will control the disease for three years. When borax was broadcast at rates from 10 to 60 lb. per acre on land in which sugar beets had shown medium to severe heart rot the year before, the treatment reduced the amount of disease and improved the quality of the beets, the juice of untreated and treated beets showing a purity of under 84 and about 86 per cent., respectively. The treatment also slightly increased the sugar content. In trials with 42 strains of garden beets for susceptibility to boron deficiency in three localities, the least susceptible (in all localities) were those of the Long Blood variety.

Trials by the same authors in 1939 and 1940 showed that the early cabbage varieties Golden Acre and Resistant Detroit were very susceptible to internal pith-browning due to boron deficiency, while the late-maturing All-Head Select, Wisconsin All Seasons, Wisconsin Ball Head, and Wisconsin Hollander No. 8 were least affected. In some instances, different strains of the same variety themselves differed in susceptibility. External symptoms of boron deficiency in cabbage under field conditions included a light yellow to white mottle along the margins of the older leaves, leaf-stunting, cross-hatching on the leaf petioles, one-sided leaves, partially developed leaves, and thickening of the leaf laminae. Some leaves had curled margins. Plants with these symptoms frequently produced normal new inner leaves later on. Affected plants were usually stunted.

As three years' work showed that an alkaline soil aggravates boron deficiency diseases, tests were also made of the effect of liming. The very susceptible Good-for-All beet showed increasing black spot with increased liming. On sandy soil there was no injury when the application was at the rate of 1,000 lb. [? per acre], while applications of 3,000, 5,000, and 9,000 lb. inducing $P_H$ values of 4·9, 5·2, and 6·7, gave 14, 26, and 40 per cent. diseased plants, respectively. On silt loam, the same variety remained unaffected when 3,000 lb. lime were applied, but showed 4 per cent. diseased plants when the soil was made slightly alkaline with 6,000 lb. lime, and 40 per cent. diseased plants when the soil $P_H$ was raised to 8 by the application of 9,000 lb. of lime. Detroit Dark Red beets remained almost unaffected on both soils under all the treatments. Experiments showed that a borax application at rates up to 60 lb. per acre is not likely to prove injurious to vegetable crops.

An extra early cabbage resistant to yellows [*Fusarium conglutinans*: ibid., xix, p. 687] has been developed, and is named Wisconsin Golden Acre.

In studies by J. C. Walker, F. J. Le Beau, O. C. Whipple, and R. H. Larson, the cabbage mosaic found locally [ibid., xix, p. 65] was ascertained to be caused by two viruses, tentatively referred to as A and B. A is largely responsible for the mosaic mottle, while B produces vein-clearing. B is largely confined to crucifers, whereas A causes mosaic on crucifers, tobacco, *Delphinium*, *Petunia*, *Calendula*, and *Zinnia*. Both A and B infect chard and spinach. Each infects cabbage independently. The disease produced by B alone is very mild, while that caused by A alone is more severe; when both are present the condition is very severe. A is rendered non-infectious by exposure to a temperature of 130° F. for

10 minutes, while B resists temperatures up to about 150° for this period.

The clover leafhopper [*Aceratagallia sanguinolenta*] was found by R. H. Larson to transmit a potato mosaic.

Greenhouse studies under controlled conditions by R. H. Larson and J. C. Walker showed that top symptoms of potato bacterial ring rot [*Bacterium sepedonicum*: ibid., xx, p. 419] become most conspicuous at temperatures of 68° to 75°. At an air temperature of 60° no disease symptoms were noted in the top growth, and diseased plants grew almost as rapidly as healthy ones. At 68°, some symptoms appeared, growth being retarded, and small bleached areas developing on the older leaves. At 75°, stunting was more severe, and the leaves showed rolling, wilting, and a yellowish discoloration. An air temperature of 82° slightly retarded the symptoms. When soil temperatures were varied, and air temperatures kept between 68° and 72°, similar results followed, except that the most severe symptoms appeared on the plants grown in soil at 82°. Young tomato plants were readily infected in inoculation tests with the potato ring rot bacterium.

Some evidence was obtained by the same authors that the early potato variety, Red Warba, and the late one, Sebago, escape serious injury from yellow dwarf [ibid., xix, p. 724].

Damping-off of conifer seedlings [cf. ibid., xviii, p. 357] in Wisconsin nurseries was found by L. F. Roth and A. J. Riker to be associated with *Pythium irregulare* and *Rhizoctonia* [*Corticium*] *solani*, both of which were ascertained to be virulent pathogens. *C. solani* caused most severe damage at temperatures between 75° and 86°, the range most favourable for the fungus, and least at 54°. *P. irregulare* showed a greater tendency to cause damping-off when the temperature was unfavourable for seedlings, even when it was also unfavourable for the fungus. It caused great damage at temperatures between 54° and 70°, at which temperatures the seedlings emerge from the soil very slowly. It appeared to be most injurious in cool weather, killing the seedlings before they appeared above the ground. To seedlings that have already emerged both fungi were most injurious at rather high temperatures. *P. irregulare* caused increasing injury as the soil moisture content increased from 13 to 100 per cent. of the moisture-holding capacity. *C. solani* was most injurious under medium soil moisture conditions (13 to 68 per cent. of moisture holding capacity). Dry soil was unfavourable to it, and it was least injurious when the soil was saturated. High air humidity favoured damping-off by *C. solani* in wet or dry soil, but had little effect on *P. irregulare*. The latter caused most damping-off at $P_H$ 6·1 and 8·5, damage decreasing at acidities over 5·2, and reaching a minimum at 4·5. *C. solani* caused least damping-off over the range most favourable to *P. irregulare*, and was most destructive at acidities above 5·2. In the field *P. irregulare* caused most damage at $P_H$ values between 5·85 and 7, while *C. solani* caused most at acidities over 5·85.

MATSUMOTO (T.). **Phage-produced resistant strains of Bacillus aroideae. III. Culture in soils and host plants.**—*Trans. nat. Hist. Soc. Formosa*, xxxi, 211, pp. 145–154, 1 fig., 1941. [Japanese summary.]

Most of the isolates of *Bacillus* [*Erwinia*] *aroideae* obtained from

phaged clay soils [*R.A.M.*, xx, p. 9] were found to be still susceptible to the lytic action of the bacteriophage specific for the organism, and only very rarely, if at all, is the so-called resistant form produced. The same applies to the pathogen when inoculated into disks of radish (its natural host). The titre of the phage undergoes little increase in clay soil, and the active principle rapidly deteriorates at temperatures exceeding 25° C. In the tissues of the host, on the other hand, it accumulates to an appreciable extent and maintains its activity over a longer period. Under natural conditions the bacteriophage probably persists for some considerable length of time both in the host and in the soil (at relatively low temperatures), and may assist in the reduction of the bacterial population.

HILDEBRAND (E. M.). **On the longevity of the crown gall organism in soil.**—*Plant Dis. Reptr*, xxv, 7, pp. 200–201, 1941. [Mimeographed.]

After referring to L. C. Cochran's paper in which he adduced circumstantial evidence indicating that *Bacterium tumefaciens* may have persisted in grain land in California for 40 years [*R.A.M.*, xx, p. 292], the author cites some examples from the literature of the subject during the last 20 years of the maximum survival periods of the organism in sterilized and unsterilized soil. The longest period mentioned is 736 days, by Patel [ibid., viii, p. 554]. The writer himself possesses unpublished data from an experiment in Kansas showing that the organism survived in field soil for two years. The usual mode of dissemination of *Bact. tumefaciens* is, probably, on contaminated plants or plant parts, while the hairy root organism [*Bact. rhizogenes*: ibid., xiii, p. 776] is similarly spread. With regard to the unusual case under consideration, it is stated that the possibility of such transmission is not excluded.

CROSIER (W.), PATRICK (S.), & WEIMER (DOLORES). **Influence of phytohormones on germination and growth of cereals.**—*Proc. Ass. Off. Seed Anal. N. Amer. 1940*, pp. 83–86, 1941.

In work at Geneva, New York, Honor winter wheat seed dusted with new ceresan (diluted with talc to give a 1 per cent. ethyl mercury phosphate dust), indolebutyric acid (100 p.p.m.), the same with new ceresan, indolebutyric acid (200 p.p.m.), the same with new ceresan, indolebutyric acid (300 p.p.m.), and the same with new ceresan showed, respectively, 64·4, 67·2, 60·8, 73·4, 67·2, 64·2, and 61 per cent. emergence, as compared with 65·8 per cent. for the untreated controls. The same treatments gave, respectively, 338, 348, 312, 349, 312, 328, and 310 heads per 100 seeds, as against 328 in the untreated controls. Details are given of other experiments with $\alpha$-naphthalene-acetamide, indoleacetic acid, and new ceresan on seeds of Honor wheat.

While the data obtained were not consistently uniform, they show that neither indoleacetic acid, indolebutyric acid, nor $\alpha$-naphthalene-acetamide induces significant increases in germination, winter survival, or seedling weights of treated wheat.

SUKHOV [SOUKHOFF] (K. S.). **On the virus proteins in cereals.**—*C. R. Acad. Sci. U.R.S.S.*, N.S., xxix, 2, pp. 137–138, 1 fig., 1940.

Winter wheat growing near Moscow was found to be affected by a

form of mosaic, the external symptoms of which resembled those of the winter wheat mosaic recently reported from Voronezh [*R.A.M.*, xx, p. 396]. Some of the outward symptoms distinguished it from 'zakooklivanie' disease of oats [ibid., xx, p. 156], from which it differed sharply in the absence of protein inclusions from the cells of affected plants. Sections of wheat leaves affected with mosaic, however, when placed in an acid medium, developed numerous needle-shaped crystals up to over 10 $\mu$ in length. Microchemical reactions indicated the protein nature of the crystals and their identity with the virus of winter wheat mosaic. The view that the wheat mosaic found near Moscow is probably identical with that reported from Voronezh was supported by the fact that crystals identical with those found in the Moscow wheat were observed in the intestines of *Deltocephalus striatus* [ibid., xix, p. 268], the vector of the Voronezh mosaic.

WATSON (I. A.). **Inheritance of resistance to stem rust in crosses with Kenya varieties of Triticum vulgare Vill.**—*Phytopathology*, xxxi, 6, pp. 558–560, 1941.

A study was initiated at the University of Sydney, in collaboration with W. L. Waterhouse, to determine the mode of inheritance of resistance to *Puccinia graminis tritici* in wheats of Kenya origin [*R.A.M.*, xix, p. 394]. Hybrid material obtained in the course of the investigations was tested in the field at St. Paul, Minnesota, in 1939 and 1940 for its reactions to at least 30 physiologic races of the rust. Two varieties, Kenya 744 and 745, were crossed with two susceptible Australian wheats, Federation 107 and Dundee 985. In 1939 the predominant races involved in the epidemic in the breeding nursery were 11, 17, 34, 36, 47, and 56, and in 1940, 15, 17, 34, 36, 49, 56, and 147. Federation 107 seedlings are fairly resistant to race 38, and the inoculation of 85 $F_3$ lines showed that the same gene controls both susceptibility to race 56 and moderate resistance to 38. A single factor for resistance to *P. graminis tritici* was found to be operative in both the Kenya varieties, irrespective of the particular susceptible parent used in the cross. An analysis of the $F_1$ plants from each of the crosses denoted that resistance is only partially dominant. The inoculation of $F_3$ seedlings of a cross between the two Kenya varieties with race 17 resulted in the development of a susceptible class, indicating the independent inheritance of factors for resistance to this race in 744 and 745. Kenya 744 has consistently proved to be somewhat more resistant than 745, the former being classed as moderately, and the latter as semi-resistant in 1940, representing a slight decline in resistance as compared with 1939.

WHITE (N. H.). **Physiological studies of the fungus Ophiobolus graminis Sacc. I. Growth factor requirements.**—*J. Coun. sci. industr. Res. Aust.*, xiv, 2, pp. 137–146, 2 graphs, 1941.

Continuing his studies at the Division of Plant Industry, Canberra, on *Ophiobolus graminis*, the agent of take-all of wheat [*R.A.M.*, xix, p. 141], the writer ascertained that biotin is indispensable to its development, while the further addition of thiamin (aneurin) doubled the amount of growth, 0·1 mg. per 100 ml. of solution being the optimum for both the vitamins (H and B, respectively). The growth factors are

present in the optimal quantities in extracts of wheat roots and straw and in 0·5 per cent. peptone [ibid., xvi, p. 373]. Soil extracts were found to be deficient in both the vitamins, as was also a 0·05 per cent. 'marmite' solution, though a 0·1 per cent. concentration of the latter contained a sufficiency of biotin. Asparagin appears to rank with wheat root and straw extracts and peptone as a source of nutriment for the pathogen.

The inability of *O. graminis* to persist in the soil in a purely saprophytic condition is attributed, on the one hand, to its dependence on specific growth factors obtainable only through the host, and on the other, to its susceptibility to the staling substances given off by many soil micro-organisms [cf. ibid., xviii, p. 733 *et passim*].

MEAD (H. W.). **The disinfecting value of fungicides used for treating cereal seeds and their influence on growth.**—*Sci. Agric.*, xxi, 11, pp. 717–726, 1 fig., 2 graphs, 1941.

To test the effect of temperature on the disinfectant value of cereal seed disinfectants seed of Mindum wheat, Hannchen barley, and of an unknown variety of oats were treated with new improved ceresan, half-ounce leytosan [see next abstract], and formalin, the treated seed stored at room temperature for a week, and the kernels then plated on acidified potato dextrose agar ($P_H$ 6), the cultures being incubated at 10°, 15°, and 25° C.

Fungal growth from the treated kernels was slow or nil at 10°, faster at 15°, and still more rapid at 25°, but was always slower and less profuse than on control kernels. Presumably the fungicides killed fungi on the surface of the seeds, but did not affect hyphae within the seed and the fact that fungi developed from treated kernels after incubation at all temperatures (except at 10° with seed treated with new improved ceresan), though less freely at the lower, supports this view. These results indicate that the effectiveness of the fungicides was influenced by temperature, and that some seed-borne fungi survived seed treatment, though their development was delayed.

In a field experiment, samples of wheat seed from 12 farms, relatively free from disease (two samples showing light infection with *Helminthosporium sativum*), were each divided into four portions which were sown in three different localities (*a*) untreated, (*b*) treated with new improved ceresan, (*c*) half ounce leytosan, and (*d*) formalin. Emergence and yield data [which are tabulated] showed that the samples reacted differently to the treatments, and that the effects of the treatments differed in the three localities, apparently owing to differences in soil type and soil moisture. Formalin treatment caused significant reduction of stand and yield, while new improved ceresan increased both, apparently significantly, and half ounce leytosan increased them slightly.

In another field test barley bearing *H. sativum* on 95 per cent. of the kernels was sown (*a*) untreated, (*b*) treated with new improved ceresan. In contrast to the previous experiment, treatment in this case significantly improved the stand and increased the yield by reducing infection throughout the season.

It is concluded that some of the differences in the infection of cereal seedlings which occur from year to year, and the apparent failure of

fungicidal control, may be due to fluctuations in soil temperature. Complete control by seed treatment of fungi borne internally cannot be expected when the soil temperature is high. The delay in the development of internally borne fungi at low temperatures in comparison with the rate of development of the seedlings is largely due to temperature, which affects both host and fungus. If the seed is sown in soil at about 12°, conditions are much more favourable for the seedling than for fungi such as *H. sativum* and *Fusarium culmorum*, for example, whereas at 20°, the optimum for the growth of these fungi, seedling infection may be severe on wheat.

MACHACEK (J. E.) & GREANEY (F. J.). **Further experiments on the control by seed disinfection of root-rotting fungi in Wheat.**—*Phytopathology*, xxxi, 5, pp. 379–394, 1941.

The outstanding results of the writers' continued and extended investigations from 1935 to 1939 at the Dominion Laboratory of Plant Pathology, Winnipeg, on the value of seed-grain disinfection in the control of *Fusarium culmorum* and *Helminthosporium sativum* on wheat were (1) that healthy seed does not respond favourably to treatment with organic mercury compounds, and (2) that the effects of such treatment on seed infected by root-rotting fungi, though often very beneficial, are liable to be inconsistent. The various dusts used, including new improved ceresan, leytosan, half-ounce leytosan, methyl mercury chloride, methyl mercury nitrate, methyl mercury iodide, and Berk IV 39 (F. W. Berk & Co., Ltd., London, England), did not differ appreciably in their influence on the percentage of seedling emergence, the incidence of root rot in the stands, and the wheat yield. Applied to healthy seed, the tests tended to reduce yields, but were without effect on seedling emergence or the development of root rot. In the case of artificial inoculation by *F. culmorum* or spontaneous infection by *H. sativum*, seedling emergence was uniformly improved by seed disinfection, which was further usually instrumental in the reduction of root rot and the increase of grain. The incorporation of ammonium phosphate with the soil increased the yield from healthy seed, and no additional advantage resulted from a combination of the fertilizer with chemical disinfection of the seed.

HARRIS (R. H.), SIBBITT (L. D.), & BRENTZEL (W. E.). **Blight and other damage of durum Wheat in 1940.**—*Bull. N. Dak. agric. Exp. Sta.* 296, 14 pp., 3 figs., 1941. [Abs. in *Exp. Sta. Rec.*, lxxxv, 1, p. 70, 1941.]

In the first part of this study R. H. Harris and L. D. Sibbitt found that blight [*Gibberella saubinetii*] and other forms of fungal infection, including *Helminthosporium*, *Alternaria*, and *Fusarium*, adversely affected the quality of the macaroni and semolina obtained from durum wheats in North Dakota in 1940, the principal damage consisting in speckling of the semolina and lack of colour in both products. The semolina yield was also less.

In the second part, W. E. Brentzel records damage to durum and hard wheat seed-grain by black point due to *Alternaria* and *Helminthosporium* and from other agencies, including *G. saubinetii*, bacteria, weakly or non-parasitic moulds, and weathering. Ceresan treatment

improved seed germination and seedling vigour. Most of the organisms encountered were kinds not originating with the seed from which the plant grew and therefore unlikely to develop in crops resulting from sowing damaged seed, but the mouldy condition of a large part of the grain and the prevalence of smut [? bunt = *Tilletia caries* and *T. foetida*] were such as to render disinfection advisable.

Ho (W. C.), Meredith (C. H.), & Melhus (I. E.). **Pythium graminicola Subr. on Barley.**—*Res. Bull. Ia agric. Exp. Sta.* 287, pp. 289–314, 7 figs., 1 graph, 1941.

Studies carried out in Iowa on barley root rot caused by *Pythium graminicola* [*R.A.M.*, xvii, p. 384] showed that the chief symptom in the field was the presence of yellow, dwarfed plants with decayed root terminals. The infected roots rapidly disintegrated. In very severe infections, the seedling fell over, dried up, and disappeared. As the season progressed, the stunted plants headed 'shorter' than healthy ones, and were conspicuously yellow, while the small tillers were dead. The lower leaves died and disappeared, and the new ones formed rosettes. Seriously affected plants stooled excessively, but few stools developed culms. The culms that succeeded in heading turned brown and dried up, and the grain was shrivelled and light and gave a seriously reduced yield.

The disease was very severe in 1936 and 1938. Seedling injury was greater at high than low temperatures, the fungus growing only very slowly at 15° C.

Oogonia and antheridia were observed in over 80 single zoospore cultures. The optimum temperature for mycelial growth in culture appeared to be 25° to 30°, the maximum between 35° and 40°, and the minimum between 5° and 10°. Data from field and greenhouse tests indicated that, of ten varieties of barley, Ministurdi was the most resistant.

Reed (G. M.). **Inheritance of smut resistance to some Oat hybrids.**—*Amer. J. Bot.*, xxviii, 6, pp. 451–457, 1941.

In further studies on the inheritance of resistance to loose and covered smuts, *Ustilago avenae* and *U. levis* [*U. kolleri*: *R.A.M.*, xx, p. 393], in oat hybrids, data were obtained for the progeny of five crosses. The inheritance of resistance to race 1 of *U. avenae* in Hybrid 81 (Gothland (susceptible to race 1) × Black Mesdag (resistant)), Hybrid 85 (Danish Island (very susceptible) × Black Mesdag), and Hybrid 87 (Green Mountain (susceptible) × Monarch (resistant)) appeared to depend on a single factor, about 25 per cent. of $F_2$ plants showing infection and the $F_3$ progenies being distributed approximately on the basis of one resistant, two segregating, and one susceptible. Inheritance of resistance to race 1 of *U. kolleri* in Hybrid 80 (Canadian (susceptible to this race) × Monarch Selection (resistant)), and race 3 of *U. kolleri* in Hybrid 87 (Green Mountain (resistant) × Monarch (very susceptible)) also depended on a single factor. In Hybrid 80 and Hybrid 86 (Monarch Selection × Gothland) both the second and third generations were as susceptible to race 1 of *U. avenae* as the parental varieties both of which were susceptible to this race. In Hybrid 81 and Hybrid 86 both parents are resistant

to race 1 of *U. kolleri*, but while the $F_2$ and $F_3$ of the latter showed complete resistance, the data for the $F_3$ generation of the former indicate that the inheritance of resistance to covered smut in this hybrid depends upon three different factors. The parents of Hybrid 87 show a contrasting reaction to race 1 of *U. avenae* and race 3 of *U. kolleri*, and the single factors governing resistance to each smut were independent of each other.

HOLTON (C. S.) & FISCHER (G. W.). **Hybridization between Ustilago avenae and U. perennans.**—*J. agric. Res.*, lxii, 2, pp. 121–128, 1941.

When *Ustilago avenae* and *U. perennans* (which have no known common host) were hybridized by inoculating wild oats (*Avena fatua*) with compatible monosporidial combinations of both species, the wild oats were infected, but no infection resulted from similar inoculations of Victory oats and tall oatgrass (*Arrhenatherum elatius*). *U. avenae* infected Victory oats and wild oats, but not tall oatgrass, while *U. perennans* infected tall oatgrass, but not Victory oats or wild oats.

Segregates with a pathogenicity similar to that of the *U. avenae* parent were recovered from the hybrid chlamydospores by inoculating Anthony oats, but segregates behaving like the *U. perennans* parent were not recovered from similar inoculations on tall oatgrass.

When the sexually opposite monosporidial lines of *U. perennans* were paired with *U. avenae*, *U. levis* [*U. kolleri*], and *U. hordei*, two different degrees of compatibility were shown, viz., sporidial fusion followed by the production of infection hyphae, and sporidial fusion without the production of infection hyphae. Infection of wild oats was given by the former type, but not by the latter.

AVIZOHAR (ZEHARA). **Inoculation of Rye with Claviceps purpurea in Palestine.**—Reprinted from *Palest. J. Bot.*, R Ser., iii, 1–2, 2 pp., 1 fig., 1940.

Ergot (*Claviceps purpurea*) has not been recorded under natural conditions in Palestine either on rye or wheat [or apparently on any other host]. In Russia the fungus is widespread in the northern parts of the country, but seldom occurs in the south and south-east. It was considered of interest, therefore, from the phytopathological-ecological point of view to ascertain whether the disease could develop in Palestine. Accordingly in May, 1940, summer rye of the *multicaule* type was inoculated at the Rehovot Agricultural Research Station with tap water suspensions of conidia of *C. purpurea* (of English origin) from potato dextrose agar cultures, the inoculum being applied to the flowers by means of a brush as recommended by Kirchhoff [*R.A.M.*, viii, p. 560]. Four typical sclerotia developed after 20 days on one of the 20 treated plants sown at a depth of 5 cm. and maintained in an excessively humid atmosphere.

ULLSTRUP (A. J.). **Two physiologic races of Helminthosporium maydis in the Corn belt.**—*Phytopathology*, xxxi, 6, pp. 508–521, 6 figs., 1941.

Two morphologically indistinguishable races of *Helminthosporium maydis* (*Ophiobolus heterostrophus* [*R.A.M.*, xviii, pp. 245, 444]) have been recognized at the Indiana Agricultural Experiment Station on the

basis of host specialization, symptomatology, and virulence, namely, 1, limited in its parasitism to one inbred line of maize (Pr.) and 2, with a somewhat wider host range, extending to line 187–2 and a number of proprietary inbreds; this race produces distinct symptoms on the foliage of its hosts, milder than those associated with race 1 and consisting in irregular, elongated, coalescent, necrotic, chocolate-brown spots, up to 20 by 3 mm. The lesions caused by race 1 are straw-coloured, of a dry, papery texture, with concentrically zonate, light to purplish-brown margins, up to 20 by 5 mm.; the profuse fructifications of the fungus under humid conditions impart a greenish-black cast to the infected areas, especially on the leaf sheaths, husks, and round the stalk nodes, while *en masse* the diseased plants present a mottled, dead, greyish-green appearance. Both races induce a black discoloration of the ears due to mycelial invasion through the tip or butt of the ear or directly by way of the husk, and the small, purplish spots developing on sugar-cane, rice, sorghum, and Sudan grass as a result of inoculation with either of the two races are indistinguishable.

It is suggested that race 1 may be indigenous to the Corn Belt, escaping notice until the severe outbreaks of 1938 and 1939 owing to its sparse development on open-pollinated plants, or it may have led a saprophytic existence pending the production of a hybrid homozygous for susceptibility. Another possibility is that it may have arisen as a mutant from the less specialized type of the pathogen known to occur in Florida [ibid., v, p. 293]. Race 2 may likewise be a native of the Corn Belt, overlooked on account of its low virulence until a relatively susceptible host developed under appropriate environmental conditions. Both races appear to be seed-borne.

ELLIOTT (CHARLOTTE). **Bacterial wilt of Corn.**—*Fmrs' Bull. U.S. Dep. Agric.* 1,878, 21 pp., 12 figs., 1 map, 1941.

Maize bacterial wilt (*Aplanobacter* [*Xanthomonas*] *stewarti*) [*R.A.M.*, xix, p. 698; xx, p. 109] in some years and in certain parts of North America causes almost complete losses of early varieties of sweet maize, such as Golden Bantam. The use of new resistant hybrids has almost solved the wilt problem as regards sweet maize, but in 1932 the disease, in a rather different form, began to threaten field maize. In 1932 and 1933 it appeared as a leaf blight on dent maize in Indiana and Illinois, infection increasing the susceptibility of the plants to stalk rot by *Diplodia* [*zeae*: ibid., xii, p. 563]. In 1938 and 1939 leaf blight again developed on dent maize in the Central States, causing losses of up to 20 per cent. in certain new hybrids.

The disease occurs throughout the maize-growing sections of the United States and has been reported from Puerto Rico, South Africa, Mexico, and Italy. In the United States the greatest losses occur in the area from Long Island to Virginia and westward, and a detailed history is given of the wilt epidemics in the United States since its first record in Long Island in 1895.

The symptoms of the disease on sweet and dent varieties are described and figured, and an account is given of how the bacteria overwinter in the beetle *Chaetocnema pulicaria* and how the disease is spread almost exclusively during the growing season by this beetle,

though wilt bacteria may overwinter in the seed to a limited extent and thereby be introduced into new areas. Few if any plants become infected through the soil, though *X. stewarti* may occasionally live over winter in soil, manure, and old maize stalks. The only feasible method of control lies in the use of resistant varieties. The sweet maize hybrid Golden Cross Bantam is resistant to early infection and widely adaptable to different soil and climatic conditions, but is too late for the earliest market, though for canning purposes it is the most widely used yellow sweet maize variety. The parents are now being used in other sweet maize crosses, in the hope that an earlier hybrid of equal qualities in other respects may be developed. Lists of new sweet maize hybrids suited to certain localities are obtainable, and some experiment stations maintain seed true to type available to commercial growers.

Marked differences in the incidence of wilt occur from season to season, and weather records offer some explanation of the variation [ibid., xvii, p. 105; xviii, p. 588; xix, p. 467]. In the northern States, where wilt is less abundant and winter temperatures are lower, the disease can be eliminated by one severe winter, whereas farther south a series of cold winters is apparently necessary to cause decided decreases in wilt. A succession of mild winters tends to build up wilt to epidemic proportions.

STEVENS (N. E.) & HAENSELER (C. M.). **Incidence of bacterial wilt of sweet Corn, 1935–1940: forecasts and performance.**—*Plant Dis. Reptr*, xxv, 6, pp. 152–157, 4 maps, 1941. [Mimeographed.]

Experimental forecasts of the probable incidence of bacterial wilt (*Phytomonas* [*Xanthomonas*] *stewarti*) [see preceding abstract] of sweet maize in the eastern United States based on the mean temperatures of the preceding winter [*R.A.M.*, xiv, p. 160] are now to be discontinued, since the results obtained during 1935 to 1940 have shown that the correlation has been so close that general forecasts can have little further interest and as local forecasts are more easily prepared and more useful. A summary is given of forecasts made and the actual occurrence of infection for each of these years is described. In 1940, the disease caused no commercially significant losses on sweet maize on the eastern seaboard north of central New Jersey, and none in Ohio or Indiana. Infection was, however, prevalent south of Pennsylvania.

HOPPE (P. E.). **Relative prevalence and geographic distribution of various ear rot fungi in the 1940 Corn crop.**—*Plant Dis. Reptr*, xxv, 6, pp. 148–152, 1 graph, 1941. [Mimeographed.]

The 1940 platings on potato dextrose agar of samples of damaged maize kernels taken from car-loads at terminal markets in the United States [cf. *R.A.M.*, xix, p. 589] showed that in Maryland and Delaware the results were markedly different from those in earlier surveys. *Diplodia zeae* accounted for only 16·2 per cent. of the damaged grain, *Gibberella saubinetii* for 21·6 per cent., and *Fusarium moniliforme* [*G. fujikuroi*] for 17·5 per cent. The corresponding percentages for Kentucky and Tennessee (together) were 42·9, 1·1, and 50·3, respectively; for Ohio, Indiana, Illinois, and Michigan (together), 64·6, 2·6, and 14·3, respectively; for Minnesota, Iowa, and Missouri (together), 57·4, 9·5, and 22·8, respectively; for Arkansas, Oklahoma, and Texas

(together) 28·6, 0, and 53·3, respectively; and for Nebraska, Kansas, and Colorado (together) 6·1, 0·2, and 72·0, respectively. A certain unidentified fungus always found in damaged grain samples from the seaboard States of Maryland and Delaware was plated from 10·2 per cent. of the damaged grain. In Kentucky and Tennessee, the ratio of *D. macrospora* to *D. zeae* was roughly 1 to 19. Data are also given on other less important pathogens.

CUSHING (R. L.), KIESSELBACH (T. A.), & WEBSTER (O. J.). **Sorghum production in Nebraska.**—*Bull. Neb. agric. Exp. Sta.* 329, 58 pp., 16 figs., 6 graphs, 4 maps, 1940.

This bulletin contains (pp. 51–53) a section on sorghum diseases prepared by J. E. Livingston. Covered kernel smut [*Sphacelotheca sorghi*] is the only constant source of severe damage to the crop in Nebraska, though considerable injury may be caused in certain years by loose smut [*S. cruenta*], head smut [*Sorosporium reilianum*], weak neck [*R.A.M.*, xx, p. 359], *Pythium* [*arrhenomanes*] root rot or milo disease, and bacterial leaf blights. Varietal field tests in connexion with weak neck, the importance of which is stated to be on the increase, indicated a considerable degree of resistance in Wheatland, Blackhull kafir, Club, and all true sorgos.

BITANCOURT (A. A.). **A leprose dos Citrus.** [Citrus leprosis.]—*Biologico*, vi, 2, pp. 39–45, 1 fig., 1940.

Leprosis is stated to be one of the most serious diseases affecting citrus in São Paulo and other regions of Brazil, including Minas Gerais and Rio Grande do Sul. The malady has also been recorded from the Argentine, Paraguay [*R.A.M.*, xx, p. 110], Uruguay, United States, China (south), Japan, India (north), Ceylon, the Philippines, Java, Lower Egypt, and South Africa. The symptoms of leprosis in São Paulo are mainly confined to the leaves and fruits, the former bearing circular to elongated, concentrically zonate lesions, 0·4 to 1·2 cm. in diameter, slightly salient on the upper surface, pale green in the centre and translucent yellowish round the periphery, imparting the effect of a halo. The affected tissues shrivel, darken, and become infected by saprophytes or weak parasites, such as *Colletotrichum gloeosporioides*. In other cases the spots are less conspicuous, but cover a larger area of the leaf surface, appearing as elliptical to irregular chlorotic areas, 1 to 2 cm. in diameter, distributed at random or localized in the lower third or half of the leaf, and surrounded by faint lines of a darker colour. On orange fruits small, yellow spots with darker centres appear when a diameter of 4 to 5 cm. is attained, and after undergoing a series of transformations develop on ripe fruits into lesions of a uniformly dark chestnut or black colour, 0·5 to 1 cm. in diameter. The concentrically zonate spots on the shoots, yellowish or pale green at first, ultimately darken to chestnut-red or chocolate colour, sometimes only round the periphery, which is more prominent than the rest of the lesion; at this stage the affected zones are elongated and measure 0·5 to 2 cm. in diameter. Gum is formed below the lesions both on the shoots and foliage, so that they appear as intumescences. Finally the darker portions of the lesions shrivel and may peel off, or the central part turns ashen- or pale grey and splits in a

longitudinal direction. The branches sometimes exhibit rough, desquamating areas liable to confusion with those due to psorosis. The prominence of foliar and fruit symptoms, as compared with those of the shoots and branches, is a distinguishing feature of leprosis in São Paulo.

The varying degrees of susceptibility of different species of citrus to leprosis in different regions is considered to denote the existence of distinct forms of the virus. In São Paulo, for instance, oranges are highly susceptible and tangerines immune, whereas the latter are subject to infection in the Argentine, though more resistant than the sweet orange. Limes of various kinds may be frequently observed in a perfectly sound condition in proximity to severely infected oranges, but they all occasionally show foliar lesions indicating the presence of a form of the virus capable of attacking limes. Lemon fruits bear deeply sunken lesions which exude gum and induce even more acute malformation than in oranges. The pomelo, rough lemon, and sour orange may also contract infection, but are generally regarded as very resistant.

The virus responsible for leprosis, a member of the 'ring spot' group, was found to be transmissible by an Acarid of the genus *Tenuipalpus*, 40 to 70 per cent. of the plants in pots situated near a severely diseased orange becoming infected, except in the case of the Sabará variety, in which only 3 out of 50 developed foliar lesions, while the tangerines remained immune. Fruits 3 cm. in diameter gathered in January were found to be free from infection on reaching maturity, whereas 80 per cent. of those remaining on the tree developed leprosis.

Drastic pruning of the diseased shoots and leaves has given excellent results in São Paulo, but is attended by one drawback, namely, the loss of the next one or two crops; this may be remedied by advancing the harvest, so as to enable the work of excision to be carried out in June, and a new flush of leaves will be formed in the following September. The areas of the trunk exposed to the sun's rays by the removal of the foliage should be treated with Bordeaux paste (1 kg.—1kg.—6l.) to obviate the formation of cankers. One or more applications of 1 per cent. Bordeaux mixture should be given in September and December. The cultivation of the resistant Sabará orange is recommended in new plantings.

BITANCOURT (A. A.). **O tratamento da leprose dos Citrus.** [The treatment of Citrus leprosis.]—*Biologico*, vii, 6, pp. 149–152, 1941.

An account is given of experiments in the control of leprosis of sweet oranges in São Paulo, Brazil [see preceding abstract], by means of 1 per cent. lime-sulphur, 1 per cent. oil emulsion (citrol), and Bordeaux mixture, the first-named substance having been successfully used for the same purpose by Frezzi (*Bol. Minist. Agric., B. Aires*, 1940), in the Argentine, where the disease was found to be transmissible by *Tenuipalpus pseudocuneatus*. The trees sprayed with 1 per cent. Bordeaux mixture from October, 1939, to May, 1940, suffered such heavy damage from infestation by cochineal insects, principally *Lepidosaphes pinnaeformis*, that the treatments had to be discontinued. Both the lime-sulphur and oil emulsion sprays produced completely healthy fruits, indicating that the spotted leaves observed at the outset of the trials must have fallen and that the virus was not perpetuated in the newly formed buds. In the untreated control block 15 out of the 24 plants

developed symptoms of leprosis, involving any fruits formed after the commencement of the experiments. One of the plants was regularly attacked by *Coccus viridis*, which was parasitized by *Cephalosporium* [or *Verticillium*] *lecanii* [*R.A.M.*, xix, p. 91] and a sooty mould (Capnodiaceae).

As a result of these tests, the author advocates the lime-sulphur treatment as an alternative to drastic pruning in mildly affected groves or even in more severe cases where the sacrifice of the forthcoming crop is undesirable. Spraying should preferably be carried out in October, January, and March. Mention has already been made of the highly resistant, in fact quasi-immune Sabará variety, as suited to new plantings, but for purposes of export such commercial varieties as Pêra or Baíaninha must of course continue to be grown.

OBERHOLZER (P. C. J.). **Suspected magnesium deficiency in Citrus.**—*Fmg S. Afr.*, xvi, 184, pp. 235–236, 2 figs., 1941.

Mature leaves of citrus trees in South Africa show a fading of the chlorophyll along the central part of the midrib, resulting in a gradual leaf-yellowing. The discoloration is mainly confined to the basal part, but as the yellowing spreads there sometimes remains a green area in the shape of an inverted V at the base of the leaf, particularly in grapefruit, the wings of the petiole generally remaining green after the whole leaf has yellowed. In severe cases, the entire leaf turns bronze and falls.

The chlorosis occurs to an alarming extent in the White River, Plaston, Karino, Mayfern, and Nelspruit areas of the eastern Transvaal, where some orchards show over 50 per cent. affected foliage. This results in gradual deterioration of the tree, followed sometimes by reduced yields. It has also been observed in the Rustenburg and Letaba citrus areas, and at Paarl and Groot Drakenstein in the western Cape Province.

A detailed study of the condition indicated that it is due to magnesium deficiency. Affected trees appear to occur on acid soils with low available magnesium. The chlorotic leaves invariably contain less magnesium than normal ones. In sand cultures similar symptoms were produced on trees presumably initially low in magnesium by omitting this element from the culture solution. Further investigations are in progress.

**The Citrus canker situation.**—*Plant Dis. Reptr*, xxv, 5, pp. 140–141, 1941. [Mimeographed.]

In the campaign against *Phytomonas* [*Xanthomonas*] *citri* [*R.A.M.*, xvii, p. 125], during the period from 1937 to 1940, 279 diseased citrus trees were found in Texas and 865 in Louisiana. In 1940, only one infected property was found in Texas, and one in Louisiana. No canker has been found in recent years in any locality in the United States where citrus-growing is carried on commercially.

ARMSTRONG (G. M.). **A solution-culture infection method used in the study of Fusarium wilts.**—*Phytopathology*, xxxi, 6, pp. 549–553, 1 fig., 1941.

The following methods provided uniformly high percentages of infection on cotton seedlings in inoculation experiments with *Fusarium*

*vasinfectum* at the South Carolina Agricultural Experiment Station [*R.A.M.*, xix, p. 592]. In the first series of tests the seed was germinated in sterilized sand in trays, and the most vigorous seedlings dipped into nutrient solution cultures of the pathogens for periods ranging from 10 to 90 minutes, after which they were transferred to regular nutrient solutions. The high percentage (37·5) of re-isolations, even of weak isolates of the fungus from a resistant variety (Sea Island), indicates that this technique affords conditions approximating to those of severe field infection. The tank or tray method represents an attempt at the further simplification of seedling production for inoculations. Soaked seed is grown in boiled and soaked 'excelsior' [wood-wool packing material] placed over the wire netting of $\frac{1}{4}$ in. mesh attached to the lower edge of a wooden frame fitted tightly into a metal tray, 21 by 13 by 8 in., to the depth of 1 in. and the roots allowed to grow into the water or nutrient solution below. Inoculations were made by dipping the roots in a nutrient solution culture of the pathogen in another tray 3 in. deep, which resulted in 80 to 100 per cent. infection. This method permits the use of a large number of plants per unit area and is also applicable to tobacco, beans [*Phaseolus vulgaris*], and cowpeas.

LIMA (A. O.). **Considerações de ordem immunologica sobre a pathogenicidade do genero Monilia.** [Considerations of an immunological order on the pathogenicity of the genus *Monilia*.]—*Brasil-med.*, lv, 17, pp. 301–305, 1941.

This is a survey of recent important contributions to the immunization of patients against pathogenic species of *Monilia* [*Candida*] by means of injections of oidiomycin.

SWARTZ (J. H.) & JANKELSON (I. R.). **Incidence of fungi in the stools of non-specific ulcerative colitis. Preliminary report.**—*Amer. J. digest. Dis.*, viii, 6, pp. 211–214, 3 figs., 1941.

Yeast-like fungi, including *Geotrichum versiforme* [*R.A.M.*, xiii, p. 636] and *Monilia* [*Candida*] *albicans*, were isolated on Sabouraud's medium from the faeces of 21 out of 24 cases (87·5 per cent.) of non-specific ulcerative colitis at Boston, Massachusetts, the corresponding incidence in a control group being 8 (33·3 per cent.). There is no evidence that *G. versiforme* is implicated in the etiology of the disease, but *C. albicans* appears to be of prognostic significance, denoting a malignant course and possibly fatal termination of the illness.

TOONE (E. C.). **Torula histolytica (Blastomycoides histolytica) meningitis: report of a case with recovery.**—*Virginia med. Mon.* (formerly *Semi-Mon.*), lxviii, 7, pp. 405–407, 1941.

*Torula histolytica* [*Debaryomyces neoformans*: *R.A.M.*, xx, pp. 363, 406] was cultured from the spinal fluid and urine of an 18-year-old negress suffering from meningitis at the St. Philip Hospital, Richmond, Virginia. The patient survived the acute phase of the disease, which responded to intravenous iodide treatment, but two years later the organism was still present in the spinal fluid.

Ghosh (L. M.). **Notes on common skin diseases. I. Ringworm of the foot.**—*Indian med. Gaz.*, lxxvi, 3, pp. 155–156, 1941.

*Epidermophyton floccosum* is stated to be the principal agent of ringworm of the foot in India. The clinical features of the disease and the factors affecting its incidence are described, and prophylactic and therapeutic measures recommended.

Ghosh (L. M.). **Notes on common skin diseases II. Ringworm of the scalp.**—*Indian med. Gaz.*, lxxvi, 5, pp. 268–270, 1941.

Juvenile ringworms of the scalp in India are of three types, caused, respectively, by *Microsporon*, *Trichophyton*, and *Achorion* spp., the last-named to form the subject of a separate communication. Microsporosis and trichophytosis are almost exclusively confined to European, Anglo-Indian, Jewish, and Armenian children in hill station schools, the rare cases observed among natives in the plains being due to *T. violaceum* [*R.A.M.*, xviii, p. 522]. Directions for differential diagnosis and therapy of the disorders in question are given.

Delamater (E. D.). **Experimental studies with the dermatophytes. III. Development and duration of immunity and hypersensitivity in Guinea Pigs.**—*J. invest. Derm.*, iv, 2, pp. 143–158, 1941.

Continuing his inoculation experiments with dermatophytes [cf. *R.A.M.*, xix, p. 92], the writer studied the effects of *Trichophyton gypseum* on guinea-pigs at the College of Physicians and Surgeons, Columbia University, New York. Allergy to the fungus was found to increase gradually during the course of infection, reaching a peak two to three weeks after the healing of the lesions and declining by degrees over a period of months thereafter. Immunity from reinfection is established concurrently with allergy during the course of infection, and appears to be closely associated with it. Such immunity likewise undergoes a gradual decline and ultimately loses its capacity for the protection of the animal. Local phenomena of complete immunity associated with diminished allergy can be demonstrated in the lesion sites. The so-called 'id' reactions and accentuated hypersensitivity are probably distinct phenomena, developed and elicited in different ways.

Lampe (P. H. J.). **Over piedra en het vóórkomen van piedra te Batavia.** [On 'piedra' and its occurrence in Batavia.]—*Geneesk. Tijdschr. Ned.-Ind.*, lxxx, 25, pp. 1519–1525, 12 figs., 1940. [English summary.]

Of 120 men and 66 women (natives) examined in Batavia, Java, for 'piedra' of the hair [*R.A.M.*, xx, p. 203], 40 and 3 (33 and 5 per cent.), respectively, were found to be infected by the 'black' form of the disease (*Piedraia*), whereas only one case of the 'white' form (*Trichosporum*) [cf. ibid., xvi, p. 383] was detected.

Lampe (P. H. J.). **Over twee vormen van 'witte' piedra en over het aantoonen van Piedraia in kaliwater.** [On two forms of 'white' piedra and on the detection of *Piedraia* in potash water.]—*Geneesk. Tijdschr. Ned.-Ind.*, lxxx, 44, pp. 2569–2572, 6 figs., 1940.

Besides the well-defined black and white forms of 'piedra' already

reported from Batavia (Java) [see preceding abstract], mention is here made of a third variety, obviously belonging to the white (or rather pale) category since a *Trichosporum* (not yet identified) is consistently isolated from the infected material, but characterized by brown nodules. In one of the two patients affected by this type of 'piedra', the ordinary black nodules developed concurrently with the brown ones. Boedijn has identified the causal organism of the black form as *Piedraia javanica* [*R.A.M.*, xviii, p. 27], the colonies of which on Sabouraud's agar are dark brown to black and almost entirely submerged with frayed edges. The *Trichosporum* colonies from the white nodules are pale yellow to white, superficial, with finely rugose, cerebriform convolutions, while those of the brown form are similar, but of a darker colour and with less rugose and much coarser convolutions.

*P. javanica* was isolated from one out of some hundreds of cultures of potash water samples from the public baths which are suspected of acting as a source of infection.

Beresova (Mme J. F.) & Naoumova (Mme A. N.). **Bakterielle Methode zur Bekämpfung pilzlicher Krankheiten der landwirtschaftlichen Pflanzen. 1. Saatbakterisation als Mittel zur Bekämpfung von Krankheiten des Leins. 2. Der Einfluss der Saatbakterisation auf den Befall der Keimpflanzen des Sommerweizens mit parasitischen Pilzen und auf seinen Ertrag. 3. Mykolytische Bakterien im Wurzelsystem der Pflanzen.** [A bacterial method for the control of fungous diseases of agricultural plants. 1. Seed 'bacterization' as a means for the control of Flax diseases. 2. The influence of seed 'bacterization' on the infection of Summer Wheat seedlings by parasitic fungi and on the yield of the crop. 3. Mycolytic bacteria in the root system of plants.]—*Микробиол.* [*Microbiol.*], viii, pp. 186–197, 198–205, 695–699, 1939. [Russian. Abs. in *Chem. Zbl.*, cxii (ii), 1, pp. 100–101, 1941.]

Note 1 of this series is contributed by J. F. Beresova, 2 by A. N. Naoumova, and 3 by both authors jointly. In laboratory experiments at the Moscow Institute of Agricultural Microbiology, the increase of germinability of flax seed treated with mycolytic bacteria [cf. *R.A.M.*, xviii, p. 659] amounted to 10 per cent. over the control samples, the corresponding figures for decrease of heavy and milder infection by *Fusarium* [*lini*] being 40 and 19 per cent., respectively; at harvesting the incidence of wilt was 15 per cent. less in the stands from treated seed than in those from non-'bacterized', with a 10 to 12 per cent. heavier yield. $B_{17}$ generally gave the best results of the strains tested, though in some cases $F_{24}$ afforded the maximum stimulus to production. Dry preparations are less apt to injure the seed than liquid ones, peat being preferable to kaolin as a base, except on light sandy soils. Compared with chemical seed treatment, 'bacterization' occupies an intermediate position, being superior to the standard disinfectant PD and somewhat less effective than granosan, which has not yet been put on the market.

Of the bacteria used in experiments for the control of *Fusarium* in summer wheat, $F_8$ and $F_{24}$ (*Pseudomonas*) and $B_{17}$ (*Achromobacter*) were the most efficacious both for healthy and diseased seed samples,

the percentage of healthy seedlings being raised from 87 to 93 per cent. in the former and from 41 to 48 per cent. in the latter. In pot trials the grain yield was increased by 30 and 29 per cent. by $F_{24}$ and *Az*[*oto-bacter*] *vinelandii*, respectively. The organisms were best applied to the seed-grain in a peat base.

Under similar conditions and in the same soils the number of mycolytic bacteria is larger in the root system of the Leguminosae than in flax and grasses. The bacterial population fluctuates according to the stage of growth of the host, reaching a maximum during flowering. Seed 'bacterization' with strain $F_{24}$ substantially increases the number of mycolytic bacteria in the root systems of flax and wheat.

MUSKETT (A. E.) & COLHOUN (J.). **Prevention of seed-borne diseases in the Flax crop.**—*Nature, Lond.*, cxlviii, 3746, pp. 198–199, 1941.

The seed disinfectant RD7846 (methylthiuram disulphide), with which satisfactory control of seed-borne flax diseases [*Colletotrichum lini* and *Polyspora lini*] has been obtained in Northern Ireland [*R.A.M.*, xx, p. 261], is now known as 'nomersan'. Bulk supplies of the fungicide, secured through the agency of Imperial Chemical Industries, Ltd., and Plant Protection Ltd., were used with machines of the Strickland pattern for the treatment of upwards of 2,000 tons of seed during the season of 1941. Occasional cases of skin irritation through contact with the powder were reported, and protection of the eyes is advisable when sowing. Ceresan U. 564 also gave good results by the short-liquid method, using the Kontramix continuous seed-treating apparatus [ibid., xiv, p. 519]. The crops from seed treated by either method showed good growth with no phytocidal effect.

TYSDAL (H. M.) & KIESSELBACH (T. A.). **Alfalfa in Nebraska.**—*Bull. Neb. agric. Exp. Sta.* 331, 68 pp., 14 figs., 1 graph, 1941.

In addition to scattered references of phytopathological interest, this bulletin contains (pp. 56–60) a section on lucerne diseases, in the preparation of which the writers were assisted by R. W. Goss and J. H. Jensen. Tables are given on pp. 28–30 summarizing the data obtained in all the controlled bacterial wilt (*Phytomonas insidiosa*) [*Aplanobacter insidiosum*] varietal tests carried out in Nebraska from 1929 to 1938, from which it appears that the Turkistans are greatly superior, both in stand survival and resistance to the pathogen, to most of the strains comprising the Common, Spanish, and Chilean groups, with the exception of the newer varieties, such as Hardistan, Orestan, and possibly Ladak [*R.A.M.*, xx, p. 472]. Biennial rotation delayed the development of the disease, but failed to eliminate the causal organism.

Notes are also given on the leaf spots, *Pseudopeziza medicaginis*, *Pyrenopeziza medicaginis*, and *Ascochyta* spp., stem blight (*Pseudomonas medicaginis*), and rust (*Uromyces striatus*).

SULLIVAN (J. T.) & CHILTON (S. J. P.). **The effect of leaf rust on the carotene content of white Clover.**—*Phytopathology*, xxxi, 6, pp. 554–557, 1941.

Comparative analysis at the United States Regional Pasture Research Laboratory, State College, Pennsylvania, of the carotene contents and thus the potential vitamin A activity of white clover (*Trifolium

*repens*) leaves infected by rust (*Uromyces trifolii* [var.] *trifolii-repentis* [*U. trifolii-repentis*: *R.A.M.*, xiv, p. 241]) and those of adjacent plants protected by sulphur dust showed the former to contain 21 per cent. less than the latter. Where no rust was present the treatment reduced the carotene content of the foliage by 10 per cent. Heavily and lightly infected leaves averaged 45 and 24 per cent. less carotene, respectively, than healthy ones on the same plant.

HIRSCHHORN (ELISA). **Nota sobre 'Ustilago bullata'.** [A note on *Ustilago bullata*.]—*Rev. argent. Agron.*, viii, 2, pp. 160–164, 1 fig., 1941.

Following a summary of Fischer's recent studies on physiologic specialization in *Ustilago bullata* on grasses in the United States [*R.A.M.*, xx, p. 347], the writer makes some observations on promycelial development in isolations of the smut from *Hordeum* and *Bromus* spp. in Neuquén, Argentina: (1) from *H. jubatum* produces numerous uni- to bicellular promycelia with an abundance of sporidia of uniform shape and diameter; (2) from *H. compressum* is characterized by bi- to quadricellular promycelia with few sporidia, the length and septation of which differ from those of any of the other collections hitherto made; (3) from *B. macranthus* gives rise to very short, bicellular promycelia, the cellular fusions being effected by means of a tube; (4) from *B. mollis* likewise produces short uni- or bi-, in one case tricellular promycelia; and (5) from *B. unioloides* is characterized by stout, bicellular promycelia with numerous sporidia and fused sporidia. Differences such as the foregoing in the dimensions and number of promycelial cells may well serve as an additional diagnostic character for the various physiologic races of *U. bullata*.

FISCHER (G. W.) & LEVINE (M. N.). **Summary of the recorded data on the reaction of wild and cultivated grasses to stem rust (Puccinia graminis), leaf rust (P. rubigo-vera), stripe rust (P. glumarum), and crown rust (P. coronata) in the United States and Canada.**—*Plant Dis. Reptr Suppl.* 130, 30 pp., 1941. [Mimeographed.]

In view of the interest taken in the United States and Canada in the improvement in local grasses through breeding, selection, and disease control, the authors have brought together a considerable mass of material (much of it previously unpublished) on the reaction of these grasses to rusts (*Puccinia* spp.). This material they present in the form of two tables, one of which summarizes the records of the known reactions of 350 species of native and introduced grasses in the United States and Canada to *P. graminis*, *P. rubigo-vera* [*R.A.M.*, xii, p. 499], *P. glumarum*, and *P. coronata*, while in the second the results are presented for *P. graminis agrostidis*, *P. graminis avenae*, *P. graminis phlei-pratensis*, *P. graminis poae*, *P. graminis secalis*, and *P. graminis tritici*. These tables are followed by a bibliography of 93 titles, showing the sources of the published data given in the tables.

IVANOFF (S. S.). & KEITT (G. W.). **Relations of nectar concentration to growth of Erwinia amylovora and fire blight infection of Apple and Pear blossoms.**—*J. agric. Res.*, lxii, 12, pp. 733–743, 1941.

In experiments in Wisconsin, fireblight bacteria (*Erwinia amylovora*)

[*R.A.M.*, xvii, p. 48] grew best in 2 to 4 per cent. concentrations of sugar in 1/400-cc. drops of artificial nectar in van Tieghem cells, their growth decreasing rapidly with increased sugar concentration, none occurring at 30 per cent. In nectar drops containing 20, 30, and 40 to 50 per cent. sugars the bacteria survived for 48, 24, and less than 24 hours, respectively. When test-tubes partly filled with artificial nectar solution containing 40 per cent. sugar were heavily seeded, enough bacteria survived for 72 hours to induce infection in pear blossoms. In greenhouse infection experiments with potted dwarf Bartlett pear trees, 10 bacteria in a 1/400-cc. water drop were found to constitute a highly efficient inoculum causing 66 per cent. of blossom infections as compared with 91 and 93 per cent. caused by 100 and 1,000 bacteria in the drop, respectively. Sugar concentrations in nectar under natural conditions in orchards during May and June were recorded by means of an Abbé refractometer. The limited data obtained show the strong predominance of nectar concentrations that would preclude multiplication of the bacteria and would be unfavourable for their survival. The early morning readings showed concentrations favourable for infection, while those taken later in the day usually did not. In field experiments where the unwounded pear and apple blossoms were inoculated with droplets of bacterial suspensions in artificial nectar solutions, infection occurred freely at low concentrations of nectar (1 to about 5 per cent.), but was rare or absent at high concentrations (40 per cent.). However, infection occurred somewhat later when the concentrated nectar was sufficiently diluted by some natural process soon enough after inoculation.

Keitt (G. W.) & Ivanoff (S. S.). **Transmission of fire blight by bees and its relation to nectar concentration of Apple and Pear blossoms.**—*J. agric. Res.*, lxii, 12, pp. 745–753, 1 fig., 1941.

In Wisconsin experiments transmission of fireblight bacteria, (*Erwinia amylovora*) [see preceding abstract], from contaminated to healthy pear and apple blossoms by honey bees was demonstrated by three different methods, the most successful involving the use of individual bees handled in a specially designed wire cage. The bees were attracted to diseased blossoms on a tree inoculated five days earlier and transmitted the disease therefrom to healthy blossoms. In a greenhouse trial contaminated bees freely transmitted fireblight to healthy blossoms when the sugar concentration of the nectar ranged from 2 to 8 per cent., but not when it was 45 per cent. or higher. In the field, where bees were allowed to sip nectar containing 2 to 12 per cent. sugars from inoculated blossoms and then from uncontaminated ones with nectar containing 0 to 35 per cent., 49 per cent. of the blossoms became diseased. On the other hand, no infection resulted when the nectars of inoculated blossoms contained 10 to 14, 42 to 56, or 48 to 75 per cent. sugars, respectively, and that of healthy ones 10 to 18, 44 to 47, and 46 to 70 per cent., respectively. These results indicate that nectar concentration is a very important factor limiting blossom blight transmission by bees. However, since no infection occurred in many cases in which nectar was at a favourable concentration, it is concluded that there may be also some other limiting factors.

PERLBERGER (J.). **A heart-rot of Apple trees caused by Diplodia sp.**—Reprinted from *Palest. J. Bot.*, R Ser., iii, 1–2, 3 pp., 1 fig., 1940.

A species of *Diplodia*, characterized by single pycnidia, averaging 300 to 500 by 200 to 500 $\mu$, and thick-walled, elliptical, brown, striate, uniseptate spores, 16·4 to 23·4 by 11 to 16·5 (average 19 to 22 by 13·75) $\mu$, was isolated from the rotted brown heart wood of Duchess of Oldenburg and Grand Alexander apple trees prepared for top-working with another variety in the winters of 1938–9 and 1939–40 near Rehovot, Palestine. This appears to be the first record of a *Diplodia* in connexion with a heart wood rot of deciduous fruit trees. The spores of the pathogen were compared with those of *D. griffoni*, reported as an agent of bark canker and die-back of apple trees in New Zealand [*R.A.M.*, iii, p. 340] and England [ibid., iii, p. 43], respectively, and found to be distinct, whereas they closely resembled those of a species of *Diplodia* isolated from citrus trees and fruits by F. Littauer, who inoculated the author's fungus into citrus fruits and produced the typical stem-end rot associated with *D. natalensis* in Palestine [ibid., xix, p. 88]. Pending further investigations, however, the apple-rotting organism is not definitely identified. Apple wood is penetrated much more deeply (80 to 120 cm. from the point of infection) than that of citrus.

KESSLER (H.). **Schlussfolgerungen aus einem Lagerungsversuch mit der Sorte Schöner von Boskoop.** [Conclusions from a storage experiment with the Beauty of Boskoop variety.]—*Schweiz. Z. Obst-u. Weinb.*, l, 13, pp. 279–284, 1 graph, 1941.

After approximately 5½ months' storage (October to April, 1940–1), the loss due to [unspecified] fungal decay, internal breakdown, and severe skin browning [? scald] in Beauty of Boskoop apples harvested on 5th October and stored at ordinary cellar temperature amounted respectively, to 3, 0, and 0 per cent., for one tree, 29, 0, and 4 per cent. for another, and 52, 0, and 2 per cent. for a third, the corresponding figures for fruit stored at 4° being 3, 0, and 0; 21, 0, and 3; and 31, 0, and 4, respectively, and for that stored at 0°, 5, 17, and 0; 8, 44, and 0; and 23, 30, and 0, respectively. For fruit from the first tree, harvested on the 21st October, the percentages were 1, 0, and 0 at ordinary cellar temperature; 6, 0, and 3 at 4°; and 2, 13, and 0 at 0°. It is apparent from these data that a constant temperature of 4° is most conducive to the maintenance of soundness during storage in the variety in question, a conclusion not new, but one on which it is necessary to insist in view of the prevalent Swiss practice of storing Beauty of Boskoops at 0° to 1°.

MCWHORTER (O. T.). **Sulphur dust, spray controls brown rot.**—*Bett. Fruit*, xxxvi, 1, pp. 5, 13, 1941.

Under Oregon conditions, control of brown rot of stone fruits [*Sclerotinia fructicola* and *S. laxa*: *R.A.M.*, xix, p. 550] is advised by sulphur dusting or wettable spray, using a brand of sulphur at least fine enough to pass through a 325-mesh screen. About ½ lb. of dust (not less) is required for each tree. Wettable sulphurs are applied at the rate of 6 lb. per 100 gals., the entire tree being covered, especially the centre. Treatment should be effected whenever infection appears on the developing fruit, at any

time after the beginning of July. If rain falls soon after the application, another must be made.

To protect peaches before and at harvest time, treatment should be effected five weeks before ripening and again 10 and 20 days later. This gave excellent control in 1940.

WILLISON (R. S.). **Studies in maturity and cold storage of Peaches.**—*Sci. Agric.*, xxi, 10, pp. 624–645, 5 graphs, 1941.

In studies on the effect of temperature on the keeping quality of peaches in storage, tests were made at 45° and 33° F. during four seasons with the early variety Rochester and the late variety Elberta, and during three seasons with the mid-season varieties Valiant and Vedette.

Internal breakdown generally was of the diffuse or invasive kind, and usually began with the appearance of minute bubbles in the intercellular spaces of the flesh, from about $\frac{1}{16}$ in. beneath the skin inwards, and advanced towards the pit until the entire flesh was affected. Aeration of the flesh was often accompanied or succeeded by a pink discoloration which rapidly changed to brown. This flesh-reddening was noted in stored peaches, but usually developed in lots removed to room temperature after prolonged exposure to cold. In some cases breakdown was so rapid that internal browning was the first sign of trouble. When invasive internal browning had set in, the affected areas became discernible through the skin, and the fruit felt spongy and dead. At first, breakdown slightly increased the resistance of the flesh to pressure, and made cutting of the flesh with a knife audible. After the peaches had been in cold storage for some time, especially at 33°, the onset of breakdown was expedited by raising the temperature of the fruit. In non-cooled peaches kept at room temperature, physiological breakdown either did not occur, or it was concealed by internal fungal decay developing three to four weeks after picking from mould infection [unspecified] through the stem scar.

A second radiating form of internal browning, less common and less extensive than the invasive type, began at the pit and progressed outwards through the flesh. In some years, browning was preceded by a reddish line in the flesh next to the pit, or by reddish streaks radiating through the flesh from the vicinity of the pit suture. This type of breakdown occurred most frequently in the Elberta variety.

Small, injected, water-soaked areas also developed near the pit suture or partly or completely round the pit, particularly in Elberta peaches. This condition was found in fruit long in storage, but it also developed on peaches left on the trees until over-ripe. In advanced stages, the injected tissues dried out into a series of lenticular cavities in the flesh next to the pit; this generally occurred when the flesh was badly affected by invasive breakdown.

Mealiness is regarded as a form of breakdown or as the forerunner of invasive breakdown.

The Elberta variety showed internal breakdown after 3 to $4\frac{1}{2}$ weeks at 45° and after 7 to $7\frac{1}{2}$ weeks at 33°. With Rochester peaches the time of commencement of browning varied more with the season and with ripeness at picking and ranged from after 5 to 9 weeks at 45° and 9 to 12

weeks at 33°. In general, the riper grades of peaches broke down earlier than green ones of the same pick. As a rule, discoloration developed sooner after removal from 45° than after the same storage period at 33°. As regards susceptibility to breakdown Vedette and Valiant were intermediate between Elberta and Rochester. The latter was more tolerant to storage at 33° than the former.

THORNBERRY (H. H.) & ANDERSON (H. W.). **Overwintering of bacterial spot on Peach.**—*Plant Dis. Reptr*, xxv, 9, pp. 268–269, 1941. [Mimeographed.]

Details are given of observations in various parts of Illinois supporting the writers' opinion, already expressed in 1933 [*R.A.M.*, xiii, p. 172], that *Phytomonas* [*Xanthomonas*] *pruni* overwinters in peach twigs, primary foliar attacks originating from the inoculum in spring cankers and twig infections probably remaining dormant from the autumn until the spring. Spring cankers developing on the past season's shoots have been consistently found to act as the source of primary leaf infections under local conditions in the State during the last ten years. Such cankers, owing to their scarcity and inconspicuousness, are difficult to detect, but they generally occur on the distal third of watersprouts arising from the trunk or main branches, though occasionally to be found on the terminal shoot of ordinary branches. Young, luxuriantly growing trees may bear from one to five cankers per tree in cases of severe foliar infection.

HILDEBRAND (E. M.). **Rapid transmission of yellow-red virosis in Peach.**—*Contr. Boyce Thompson Inst.*, ii, 6, pp. 485–496, 4 figs., 1941.

In greenhouse and orchard experiments carried out during 1939–40 at the Boyce Thompson Institute, New York, the virus of yellow-red virosis or 'X' disease [*R.A.M.*, xx, p. 310] was transmitted by budding from peach to peach. The symptoms, which otherwise failed to appear three months after inoculation, appeared within a month when the inoculated trees were topped, this operation apparently liberating the virus from the diseased buds and accelerating its spread through the plant. It is suggested that this rapid method of transmission may also be adapted to the study of other viruses.

HILDEBRAND (A. A.) & WEST (P. M.). **Strawberry root rot in relation to microbiological changes induced in root rot soil by the incorporation of certain cover crops.**—*Canad. J. Res.*, Sect. C, xix, 6, pp. 183–198, 1 pl., 1 diag., 1941.

In pot experiments carried out in Canada during 1936 to 1939, strawberry plants of the variety Premier were grown in naturally infected root rot [*R.A.M.*, xviii, p. 809] soil on which various cover crops had been previously grown and turned under, as well as in the same soil steam-sterilized or fertilized with farmyard manure. The results showed that strawberry plants grown in steam-sterilized soil or soil into which soy-bean had been incorporated, remained free from disease until the third season when they exhibited slight infection, whereas plants in the manure, maize, red clover, timothy, and untreated soil series all became

diseased, the severity of infection increasing in the respective series in the order named. Microscopic examination of roots of various cover crops showed that although several different genera and species of fungi were present in all, each plant favoured a specific fungus more than others. Thus, in the tomato series, out of a total infection value for fungi of 965, a value of 794 was assigned to *Rhizoctonia* [*Corticium*] *solani*, while in the soy-bean series, a value of 2,695 out of a total of 2,733 was assigned to *Thielaviopsis basicola*, and in the maize series a value of 1,483 out of a total value of 2,555 was due to *Pythium* spp. There seemed to be a correlation between the presence of these specific organisms and the incidence and the severity of the disease in the roots of the strawberry plants subsequently raised, but on the other hand, in strawberry plants grown in the variously treated soils fungal infection was negligible and apparently not related to that of the preceding cover crop. The only exception to this was the heavy infection ascribed to the mycorrhizal fungus (? *Rhizophagus* sp.) following timothy and maize, but certain inconsistencies suggested that other agencies might be responsible for the injuries. The root surfaces of healthy plants were found to harbour fewer bacteria than those of diseased ones, while the surrounding soil contained approximately equal numbers. Qualitative analyses of the bacterial groups differentiated on the basis of nutritional requirements indicated a striking relationship between the incidence of certain groups and the severity of the disease: for example, bacteria of group 3 accounted for 51·9 per cent. of all organisms on the roots of badly diseased plants, but supplied only 2·3 per cent. of those present in sterilized soil. On the other hand, bacterial groups 5, 7, and 9 comprised 46·4 per cent. of the bacterial population of healthiest roots and only 5·4 per cent. of that from severely infected plants. The equilibrium between the presumably harmful bacteria and the innocuous ones is designated the 'bacterial balance index'. The equilibrium of the different soil series showed marked differences, the lowest bacterial balance index being associated with increased severity of root rot.

West (P. M.) & Hildebrand (A. A.). **The microbiological balance of Strawberry root rot soil as related to the rhizosphere and decomposition effects of certain cover crops.**—*Canad. J. Res.*, Sect. C, xix, 6, pp. 199–210, 1 pl., 1 graph, 1941.

In further experiments on the microbiological balance of soil infested with strawberry root rot [see preceding abstract], soy-bean grown as a cover crop and incorporated into such soil induced a striking reduction in the incidence of root rot in the subsequent strawberry crop and caused a drastic change in the bacterial equilibrium of the soil; red clover had little effect on the severity of the disease or the general microbiological balance of the soil. It was demonstrated that these characteristic effects were not produced by the two cover crops while in the living state. A study of the bacteriological aspects of their decomposition, on the other hand, showed that the breakdown of the two crops under identical conditions was strikingly different, the soy-bean apparently undergoing a predominantly carbohydrate fermentation that could be reproduced in culture by the substitution of glucose for soy-bean tissues, whereas the decomposition of red clover was chiefly

putrefactive. Beneficial changes in the bacteriology of actual root-rot soils could be induced by the decomposition of pure carbohydrate in place of soy-bean. The bacterial balance was altered by the decomposed soy-bean in such a way that potentially harmful organisms were replaced by harmless ones. Strawberry plants grown in soils treated with carbohydrate produced well-developed, healthy root systems. It thus appears that the ability of soy-bean to control strawberry root rot depends primarily on a carbohydrate type of decomposition which causes a highly favourable shift in the microbiological equilibrium of the soil.

CONDIT (I. J.) & HORNE (W. T.). **Further work on Fig mosaic.**—*Phytopathology*, xxxi, 6, pp. 561–563, 2 figs., 1941.

In the southern and eastern United States fig mosaic appears to be virtually restricted to California [*R.A.M.*, xiii, p. 252], where it is spreading to *Ficus altissima*, *F. krishna*, and *F. tsiela*. It is also present in Texas, while other countries affected include England, Puerto Rico, China, New South Wales, and Western Australia. A foliar discoloration or spotting (possibly a deficiency symptom) and a form of little leaf of *F. glomerata* have been observed in California. The name *Ficivir caricae*, based on Fawcett's recent proposals for virus classification [ibid., xx, p. 174], is suggested for the fig mosaic virus.

NISIKADO (Y.), HIRATA (K.), & KIMURA (K.). **On a Phytophthora rot of Fig.**—*Ber. Ōhara Inst.*, viii, 4, pp. 427–442, 4 pl., 1 graph, 1941.

In 1935 the first severe epidemic of *Phytophthora* rot of figs occurred in the Kurasiki region of Japan, the White Genoa variety being chiefly affected. The disease was first observed in 1909 by K. Hara, who in 1915 applied the name of *Kawakamia carica* to the causal organism; in 1915 it was detected by S. Hori on the California Black variety and referred to *P. fici* (subsequently changed to *P. carica*); K. Sawada found the same fungus, also on California Black, in Formosa in 1914 (*Trans. nat. Hist. Soc. Formosa*, xxvi, pp. 174–179, 1916), while in 1935 S. Takimoto discovered it not only on the fruit, but also on the leaves, young stems, and leaf sheaths. Both Tucker [*R.A.M.*, x, p. 755] and Leonian [ibid., xiv, p. 398] regard *P. carica* as a synonym of *P. palmivora*, and the present writers adopt the same view. The hyaline, piriform, oblong, ellipsoid, ovoid, or fusoid conidia of their isolation measured 27 to 87 by 17 to 45 $\mu$, compared with 27 to 72 by 20 to 53 $\mu$ for *P. palmivora*.

The pathogen thrives in an atmosphere of extreme humidity such as prevails locally during the rainy season from May or June until the late autumn. Affected fruits turn dark green or deep purple according to the variety and present a water-soaked appearance, finally softening and dropping or, if drier conditions supervene, remaining on the tree in a mummified state. On the foliage the irregular lesions rapidly change from light to dark brown and soon cover half the surface in young leaves, but in older ones they seldom exceed 2 to 3 mm.

Inoculation experiments with pure cultures of the fig strain of *P. palmivora* gave positive results on wounded and uninjured fruits, leaves, and buds of figs, as well as on pear, apple, persimmon, tomato, and egg-

plant fruits, and potato tubers, though in the case of the last-named the symptoms were less pronounced than those induced by *P. melongenae*.

The minimum, optimum, and maximum temperatures for the growth of the fungus on potato dextrose agar were found to be from 5° to 10°, 27°, and 32° to 33° C., respectively. Slight desiccation and movement of air above the cultures were conducive to conidial production, but the sexual stage of the organism failed to develop even on Leonian's green pea decoction medium [ibid., xv, p. 597].

Meredith (C. H.). **The effect of sodium nitrate on Fusarium oxysporum cubense.**—*Phytopathology*, xxxi, 6, p. 564, 1941.

Croucher and Mitchell (*Bull. Dep. Sci. Agric. Jamaica* 19, 1940) have recommended the monthly application of sodium nitrate at the rate of 2 oz. per root near the root head for the control of Panama disease of bananas (*Fusarium oxysporum* [var.] *cubense*) in Jamaica. In tests to determine the effect of the compound on the pathogen, the spores were inactivated by the admixture of 16·6 parts to 83·4 parts of soil culture, only a few recovering sufficiently to germinate on transference to rice agar. The incorporation with clay soil of 3·125 per cent. sodium nitrate completely inhibited penetration by the *Fusarium*, while 1·538 per cent. of the fertilizer reduced the penetration from 4·1 to 2·7 cm. after 16 days.

Parris (G. K.) & Jones (W. W.). **The use of methyl bromide as a means of detecting latent infections by Colletotrichum spp.**—*Phytopathology*, xxxi, 6, pp. 570–571, 1 fig., 1941.

During the few days required for ripening by Hawaiian papaws treated against insect pests with methyl bromide and held at 50° F. for six days, anthracnose (*Colletotrichum ? gloeosporioides*) [*R.A.M.*, xix, p. 294] develops rapidly, whereas untreated fruits show little infection. Similarly, Lualualei string beans (*Phaseolus vulgaris*) subjected to the same treatment were severely rotted, not only by *C. lindemuthianum*, but also by secondary invaders (*Fusarium* and *Alternaria* spp.). These observations suggest that methyl bromide may be a useful agent in the determination of susceptibility to fungal infections which would otherwise remain latent.

McCallan (S. E. A.), Wellman (R. H.), and Wilcoxon (F.). **An analysis of factors causing variations in spore germination tests of fungicides. III. Slope of toxicity curves, replicate tests, and fungi.**—*Contr. Boyce Thompson Inst.*, xii, 1, pp. 49–78, 7 graphs, 1941.

In a further contribution to this series [*R.A.M.*, xx, p. 27] the results are given of laboratory tests of 20 compounds, representing heavy metals, commercial 'insoluble' copper fungicides, and synthetic organic materials, on *Sclerotinia fructicola*, *Glomerella cingulata*, *Alternaria solani*, *Macrosporium* [*Stemphylium*] *sarciniforme*, *Botrytis* sp. (*cinerea* type), and *Rhizopus nigricans*. The 718 individual toxicity curves obtained showed four different, reasonably constant slopes on logarithmic probability paper: (*a*) a simple straight line, (*b*) a double slope with left-hand 'break' in lower values giving a curve concave upwards, (*c*) a double slope with right-hand 'break' in upper values, or curve convex upwards, and (*d*) a triple slope or sigmoid curve, 17 per cent. of the curves being of the two latter types. The type and steepness of slope

were determined more by the compound than the fungus. It is suggested that heterogeneous compounds differing widely in slope as well as compounds of convex and sigmoid type curves should be evaluated at high LD levels [ibid., xix, p. 665] such as the LD 95. Highly significant correlations were observed between steepness of slope and toxicity at the LD 50 point for straight and concave type obtained in the heavy metal and copper series; no correlation was observed among the organic materials. The rapid graphic method of obtaining LD values was shown to give as satisfactory results as the long method of calculation and the use of the former is accordingly recommended for general comparisons.

The variations in results obtained in replicate tests were found to be due mainly to the use of different lots of fungous spores rather than to differences in the fungicidal dose. A linear relation exists between the logarithms of LD 50 and of the number of spores exposed to the fungicide. Errors in adjusting the concentration of a spore suspension for a given test account for only a small portion of the variance of replicated tests. Different fungicides may be rated approximately in terms of a standard, provided they are of essentially similar slope and chemical composition. All the fungi tested were alike in their average sensitivity to a number of fungicides, except for *R. nigricans*, which was significantly more sensitive. There was no evidence that the average sensitivity was inversely proportional to the spore volume. The fungi differed, however, in their sensitivity to specific compounds, the greatest tendency to rate them differently being displayed by *A. solani* and *Sclerotinia fructicola*. As regards reproducibility of results, ease of counting, and ready production of spores in quantity, which are considered to be the three main criteria for the selection of fungi for laboratory tests, *A. solani* and *S. fructicola* are considered the most suitable, *Stemphylium sarciniforme* and *G. cingulata* fairly so, and *B. cinerea* and *R. nigricans* generally unsatisfactory.

To give the maximum testing efficiency the following experimental design should be followed: four or five different doses; dose ratios of 2,000 or 1,414; 100 spores per count per dose; no replicate counts; graphic methods of determining LD values; evaluation at LD 50 for straight line or concave type compounds having similar slopes, and at LD 95 for dissimilar slopes and curves of convex or sigmoid type; several different fungi tested twice rather than one fungus tested a number of times; and for error term, the compound $\times$ replicate tests interaction.

**Gold Coast. Regulations made under the Plant Pests and Diseases Ordinance, 1937.**—2 pp., 1941.

Order No. 12 of 1941, to be cited as the Swollen Shoot Disease of Cacao Order, 1941 [cf. *R.A.M.*, xx, p. 47] dated 20th and gazetted 23rd May, 1941, defines the area declared to be in danger of infection, occupiers of farms lying wholly or partly within which shall, within 90 days of the coming into effect of the Order, remove all cacao plants from their land unless exempted in writing by the Director of Agriculture, whose permission is further required for the planting of cacao within the prohibited area. Regulations No. 41 of 1941 of 27th June, 1941, are concerned with amendments in the territorial definitions of the infected area.

IMPERIAL MYCOLOGICAL INSTITUTE

# REVIEW
OF
# APPLIED MYCOLOGY

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Horsfall (J. G.). **Biological assay of protective fungicides.**—*Chron. bot.*, vi, 13, pp. 292–294, 1 fig., 1941.

The information in this paper, which briefly reviews studies carried out at Connecticut Agricultural Experiment Station on the laboratory testing of the protective value of fungicides, has already been noticed from other sources [*R.A.M.*, xviii, p. 538; xix, p. 665].

Klemm (M.). **Pflanzenschutz in der UdSSR.** [Plant protection in the U.S.S.R.]—*Angew. Bot.*, xxiii, 2, pp. 41–62, 2 maps, 1941.

The writer traces the history of the plant protection service in Russia, the first section of the paper being devoted to the period from the mid-nineteenth century to 1914, the second covering the years 1918 to 1930, and the third dealing with recent developments.

The unprecedented increase of plant pests after the war of 1914 to 1918 necessitated energetic control measures, and a network of organizations was formed to meet the specific needs of the farming communities in different parts of the country, while at the same time academic studies were actively developed. In 1930 the Pan-Russian Association for Pest Control was founded, and its present activities include an observation and warning service, a quarantine commission, research institutes for agricultural aviation and chemical plant protectives, and laboratories for virus and bacterial diseases and for pathological physiology. The headquarters of the scattered regional research stations is situated at the Pan-Russian Lenin Academy of Agricultural Science, Leningrad, to which 110 scientists were attached according to the 1935 report. The estimated total losses from plant diseases and pests of the principal agricultural crops in 1933 amounted to nearly 812,000,000 roubles, among the figures cited being 406,122,200 roubles for potato blight (*Phytophthora*) [*infestans*], 238,823,400 roubles for the combined loss from apple scab [*Venturia inaequalis*], *Monilia* rots [*Sclerotinia fructigena* and *S. laxa*], and insect damage, and 26,362,000 roubles for vine downy mildew [*Plasmopara viticola*].

Panassenko (W. T.) & Tatarenko (J. S.). **Psychrotolerante Pilzflora bei Nahrungsmitteln.** [The psychro-tolerant fungal flora of foodstuffs.]—*Микробиол.* [*Microbiol.*], ix, pp. 579–584, 1940. [Russian. Abs. in *Chem. Zbl.*, cxii (i), 19, pp. 2538–2539, 1941.]

At the Ukrainian Institute for Food Industry, Kharkoff, most of the

moulds isolated from meat, fruit, and other foodstuffs in cold storage [*R.A.M.*, xviii, p. 467] belonged to the genus *Penicillium*, probably originating on the walls, packing material, and the like, in adjoining rooms with a fairly high temperature. Experiments with individual species showed them to be markedly tolerant of cold, the minimum temperature for growth in some cases, e.g., *P. puberulum* and *P. chrysogenum*, lying below—4° C. The minimum temperature for the development of most of the *Aspergillus* species tested was found to range from 6° to 12°, only one or two, such as *A. amylovorus* Panassenko, being capable of growth at 2° to 3°. Good control of the moulds was obtained by the disinfection of the walls (in the absence of whitewash) with 0·5 per cent. acetic acid.

NISIKADO (Y.). **On the heterothallism of phytopathogenic fungi.**—*Ber. Ōhara Inst.*, viii, 4, pp. 477–488, 1941.

Many of the outstanding contributions to the literature on heterothallism in phytopathogenic fungi included in the eight-page bibliography appended to the author's concise review of the subject have been noticed in this *Review* from the original sources. Attention is briefly drawn in the conclusion to the likelihood of an increase of pathogenicity in the new strains or hybrids arising from heterothallic unions, which may present grave problems to plant-breeders engaged in attempts at the development of disease-resistant varieties.

ANDRUS (C. F.). **Preparation of inoculum with a mechanical liquefier.**—*Phytopathology*, xxxi, 6, pp. 566–567, 1941.

With the aid of an instrument variously designated a blender, high-speed mixer, homogenizer, or liquefier, the need for conidia or other spore forms for mass inoculations is eliminated, and excellent results have been obtained by its use at the South-Eastern Regional Vegetable Breeding Laboratory, Charleston, South Carolina, in the infection of tomatoes with mycelial fragments of the early blight (*Macrosporium* [*Alternaria*] *solani*) and grey leaf spot (*Stemphylium solani*) organisms. The slicing and beating of the blender are accompanied by a strong centrifugal action, and in five minutes or less coarse fungal mats are reduced to particles minute enough to traverse a fine spray nozzle. The foliage of the plants may either be dipped in the liquid inoculum or sprayed with it.

YOUDEN (W. J.). **Fluctuations of atmospheric sulphur dioxide.**—*Contr. Boyce Thompson Inst.*, xi, 6, pp. 473–484, 3 graphs, 1941.

In the course of studies at the Boyce Thompson Institute, situated 15 miles north of New York City, on sulphur dioxide injury to plants, continuous records showed that the concentration of the gas in the atmosphere [*R.A.M.*, xix, p. 34] follows a daily cycle that changes with the seasons. In winter the concentration builds up during the day and falls off in the evening, and in other seasons it drops in the early afternoon, probably as the result of northerly breezes. There is also a weekly cycle which is the same at all seasons, in which the concentration is low on Sunday and Monday, increasing by about 50 per cent. to a maximum on Thursday and Friday, possibly owing to the greater industrial activity during the week, although this is thought doubtful. The

annual cycle follows a sine-shaped curve with a minimum of 15 parts of sulphur dioxide per 1,000,000,000 of air in the summer to a maximum of 50 in the winter. A strong correlation was found to exist between the sulphur dioxide concentration and wind direction and velocity, temperature, and to some extent rainfall.

THOMAS (W. D.). **The mycorhizal fungi and mycorhizae of four coniferous plantations in the Rhine Valley.**—*Phytopathology*, xxxi, 6, pp. 567–569, 1941.

Four 1-ha. plots of young pine (*Pinus sylvestris* and *P. strobus*), spruce (*Picea abies*), and larch (*Larix europaea*) near Karlsruhe in the Black Forest were examined for the presence of Hymenomycetes and mycorrhiza, two being located on sandy soil and two having a rich covering of humus. The sandy plots were entirely destitute of mycorrhiza, which were scanty, moreover, in one of the others formerly planted with oaks, but occurred in profusion in the remaining humus plot. The organisms associated with *Pinus sylvestris* [*R.A.M.*, xix, p. 488] were *Amanita muscaria*, *Boletus badius*, *B. granulatus*, *B. luteus*, *B. variegatus*, *Lactarius deliciosus*, and *Russula fragilis*; with *P. strobus*, *A. muscaria*, *B. porosus*, *B. bovinus*, *B. castaneae*, *B. granulatus*, *B. luteus*, *Cantharellus ciborius*, *L. chrysorrheus*, and *L. deliciosus*; with *Picea abies*, *A. muscaria*, *B. luteus*, *Cortinarius balteatus*, and *L. deliciosus*; and with *Larix europaea*, *A. muscaria*, *B. granulatus*, *B. luteus*, *B. variegatus*, and *C. camphoratus*. The trees with abundant mycorrhizal associations were the only ones of a healthy aspect and promising high yields.

BARROWS (F. L.). **Propagation of Epigaea repens L. II. The endophytic fungus.**—*Contr. Boyce Thompson Inst.*, xi, 6, pp. 431–440, 2 figs., 1941.

A mycorrhizal endophytic fungus was isolated in 1935 in Connecticut from rooted cuttings, collected plants, and seedlings of *Epigaea repens* [*R.A.M.*, iii, p. 224]. It was present in the stems and roots, on the flowers, pollen, and young ovules, on and in the mature fruit, and on the surface of freshly-ripened seeds. It is believed that the fungus becomes established in young seedlings from the hyphae present on the seed coat. The fungus occurs normally in the soil and *E. repens* cuttings were found to grow better in its presence.

The fungus grew rapidly on potato dextrose agar or in a 2 per cent. maltose solution, developing a cottony, white to pink aerial mycelium on the former and a submerged and gelatinous mycelium in the latter medium. Young, vigorous cultures were usually lighter in colour than older ones, very old cultures occasionally showing a purplish-red or red-brown colour. The pigment was found to be in the hyphal walls, being either distributed uniformly throughout the wall or deposited as granules. The hyphae were thin-walled and slender, with cross walls in the older ones; the aerial mycelium formed numerous conidia; chlamydospores, both terminal and intercalary, were frequent in submerged mycelia on maltose or in the older and somewhat desiccated cultures on potato dextrose agar and closely resembled those found in and on the roots containing mycorrhiza. The endophyte survived months of drying. Further investigations are necessary for the identification of the fungus.

BLUMER (S.) & SCHOPFER (W. H.). **Beiträge zur Biologie und Wirkstoffphysiologie von Ustilago scabiosae (Sowerby) Winter.** [Contribution towards the biology and vitamin physiology of *Ustilago scabiosae* (Sowerby) Winter.]—*Ber. schweiz. bot. Ges.*, 1, pp. 248–272, 1 fig.,3 graphs, 1940.

In the course of further studies on the effect of aneurin on the growth of *Ustilago scabiosae* [*R.A.M.*, xvii, p. 618], the authors obtained as good growth of recent Swiss isolations of the smut from *Knautia arvensis* and *K. silvatica* with the optimum concentration of aneurin (0·02 $\gamma$ per 25 c.c. of culture solution) as with an equivalent mixture of pyrimidin and thiazol but at a higher concentration (0·05 $\gamma$ per 25 c.c.). The results of an investigation of the ability of *U. scabiosae* to utilize different sources of carbon and nitrogen are tabulated, as is the effect of the glucose-asparagin concentration on copulation.

BAUCH (R.). **Experimentelle Mutationslösung bei Hefe und anderen Pilzen durch Behandlung mit Campher, Acenaphthen und Colchicin.** [The experimental release of mutations in yeast and other fungi by treatment with camphor, acenaphthene, and colchicin.]—*Naturwissenschaften*, xxix, 32–33, pp. 503–504, 2 figs., 1941.

The writer's experiments with brewery yeasts and other fungi at the Rostock (Germany) Botanical Institute have shown that camphor, acenaphthene, and (to a lesser extent) colchicin are capable of inducing in these organisms chromosomal aberrations comparable to those developing in flowering plants treated with analogous substances. For instance, camphor (natural or synthetic) fumes at a certain concentration bring about in yeasts the production of long, filiform, pluricellular mycelia, which either disintegrate through collapse of plasma or proceed to the formation of abnormally large cells by budding. Some of the aberrant strains thus derived, presumably tetraploid or multivalent chromosomal forms, were characterized by important differences in size as compared with the original clone. In some cases they grow quite as abundantly as the parent and show equal or greater fermentative activity.

PAL (B. P.). **A note on an important virus disease of Potatoes in India.**—ex *Abs. Pap. Tenth ann. Sess. nat. Acad. Sci., India,* 1 p., 1941.

The author states that the important 'mosaic' disease of the Phulwa (= Patna White) potato variety in India has been identified by R. N. Salaman as due to potato virus Y. Observations at New Delhi showed that incidence was greater in earlier than in later plantings, and was effectively reduced by roguing.

OFFERMANN (A. M.) & VITORIA (E. R). **Estudio sobre un virus productor del 'marchitamiento apical de la Papa'.** [Study on a virus producing 'top necrosis of the Potato'.]—*Rev. argent. Agron.*, viii, 2, pp. 105–113, 2 pl., 1941.

Under local conditions in the Argentine, the serious potato disease caused by *Solanum* virus 1 [potato virus X] is stated to be liable to confusion with early blight (*Alternaria solani*), dark chestnut, concen-

trically zonate foliar lesions being common to both; symptoms of the virus, however, occur on the young tissues and are confined to the upper side of the leaves, while the fungus attacks the older ones and further involves both leaf surfaces, imparting to the veins of the lower an almost black colour. The virus also affects the stems and tubers, causing necrosis of the terminal buds and eyes, respectively. The virus induces on tomatoes inoculated with expressed juice symptoms reminiscent of those due to *Lycopersicum* virus 3 [spotted wilt], but the two infective principles may be distinguished by their reaction to mercuric chloride, which at a strength of 1 in 1,000 immediately inactivates the spotted wilt virus, whereas potato virus X retains its virulence in contact with the disinfectant for five days. The potato virus is filterable through Kieselguhr H, Chamberland L5 and L3, and Berkefeld W and N candles; is inactivated partially at 65° and totally at 75° C.; tolerates a dilution of 1 in 1,000; retains its infective capacity for a fortnight in the refrigerator at 5°, but shows an appreciable diminution of virulence after two months under these conditions; and is pathogenic to tomato, potato, tobacco, chilli, and sometimes dahlia, but not to Calla lily [*Zantedeschia ethiopica*], a common host of spotted wilt in the Argentine.

The virus was purified according to Bawden and Pirie's technique [*R.A.M.*, xviii, p. 756] and the resultant opalescent, whitish solution inoculated into tomato plants at dilutions of 1 in 10 and 1 in 100 with positive results. The leaves of diseased plants were found to contain a higher proportion of the infective principle than the stems.

FLINT (L. H.) & EDGERTON (C. W.). **Fluorescence of diseased Potatoes.**—*Phytopathology*, xxxi, 6, p. 569, 1941.

In the course of routine inspections in Louisiana, the cut surfaces of potato tubers affected either by ring rot (*Bacterium sepedonicum*) or stem-end rot (*Fusarium* [*solani* var.] *eumartii*) were found to fluoresce under ultra-violet radiation, so that this phenomenon is not, as was thought by Harvey (*Phytopathology*, xxxi, p. 10, 1941), diagnostic for ring rot, which must be tested for with Gram stain.

IVERSON (V. E.) & KELLY (H. C.). **Control of bacterial ring rot of Potatoes with special reference to the ultra violet-light method for selecting disease-free seed stock.**—*Bull. Mont. agric. Exp. Sta.* 386, 15 pp., 4 figs., 1940.

Mention has already been made of the successful results obtained in Montana in the detection of bacterial ring rot (*Phytomonas sepedonica* [*Bacterium sepedonicum*]) by means of a 100-watt, 220-volt, H-4 natural red-purple lamp (General Electric Company) [*R.A.M.*, xx, p. 274]. The examination should be made at storage temperatures in a well-darkened room. The best knife disinfectants were found to be acid mercury (1 in 500), mercuric chloride (1 in 500), and an iodine-potassium iodide solution made up by P. A. Ark (*in litt.*, unpublished) at the California Agricultural Experiment Station as follows: 37·8 gm. iodine, 75·6 gm. potassium iodide, 1 pint glycerine, and 2 gals. water (five-second dips in all cases), while the most effective tuber antiseptics were mercuric chloride (1 in 1,000, three minutes) and iodine solution, prepared as above with the omission of the glycerine and using only 1 gal. water

(three minutes), which reduced the incidence of infection from 86·3 to 4 and 6·1 per cent., respectively, the corresponding figures for new improved semesan bel and mercuric chloride 1 in 2,000 being 10 and 18·3 per cent., respectively. Semesan bel and the iodine mixture reduced the percentage of emergence by 12 and 2·2 per cent., respectively.

GODFREY (G. H.). **Potato seed-source control suggested for elimination of late blight in Lower Rio Grande Valley.**—*Plant Dis. Reptr*, xxv, 9, pp. 267–268, 1941. [Mimeographed.]

The circumstances [which are described in detail] attendant on a severe epidemic of late blight (*Phytophthora infestans*) in the spring potato crop in the Lower Rio Grande Valley, Texas, in 1941 suggest the rigid exclusion from the district of all seed except that originating in disease-free States (Nebraska and North Dakota, from which most of the seed is obtained, being virtually free from blight). This measure should effectively prevent the development of severe outbreaks of late blight in the Valley, since it is improbable that the causal organism, which thrives over a low temperature range, would survive a subtropical summer and no alternative hosts have been found to harbour it, while the likelihood of long-distance transmission from Louisiana or Florida is considered to be remote.

HAHN (G. G.). **Reports of Cedar blight in 1940 and notes on its previous occurrence in nurseries.**—*Plant Dis. Reptr*, xxv, 7, pp. 186–190, 1941. [Mimeographed.]

In recent years, blight (*Phomopsis juniperovora*) [*R.A.M.*, xix, p. 444] has become a difficult problem in those nurseries of the Mississippi Valley States where cedars are propagated; the disease is regarded as particularly serious in this area, as eastern red cedar (*Juniperus virginiana*) has increased in popularity locally for farmstead windbreaks.

In Iowa and Missouri, cedar blight in nurseries at Ames and Ellsberry was much less active in July, 1940, than at any time in the previous three years, apparently owing to a very dry spring. About the third week in July, however, an epidemic developed in two nurseries in Iowa, and became more severe than the outbreaks experienced in 1937 and 1938. In a two-acre area planted with *J. virginiana*, all of 2,000 seedlings examined were infected. Spread became greatly reduced in the first week of September, when dry weather set in. Between 20th July and 1st September the whole stock was rogued three or four times, with a total loss of approximately 30 per cent. The disease was quiescent during the dry, cold spring, but became rampant when exceptionally wet, cool weather developed in July and August.

In eastern Nebraska infection was worse during 1940 than at any other time in recent years. In a nursery at Fremont, Rocky Mountain juniper (*J. scopulorum*) was as badly infected as *J. virginiana*.

In Minnesota and Wisconsin, infection, though present, was light. During the year, the first authenticated record of the disease as a nursery problem in Oklahoma was received. Only one case appears to have occurred in Texas nurseries; this was in 1929, when the fungus was identified on *J. chinensis* seedlings introduced from Illinois. Specimens

of Italian cypress (*Cupressus sempervirens*) collected in Texas in 1928 bore *P. occulta* (*Diaporthe conorum*), and care should be taken not to confuse the fungus on Cupressaceous specimens with *P. juniperovora*.

In a Virginia nursery and another in North Carolina, infection was less serious than in the two previous years. Thin stands appeared to be a controlling factor, as in South Carolina, where the disease has not yet been recorded.

FINDLAY (W. P. K.) & PETTIFOR (C. B.). **Dark coloration in Western Red Cedar in relation to certain mechanical properties.**—*Emp. For. J.*, xx, 1, pp. 64–72, 2 graphs, 1941.

Experiments made to test the strength properties of samples of western red cedar (*Thuja plicata*) heartwood showing a dark red discoloration, as compared with the strength properties of samples having a normal colour, showed that the dark-coloured heartwood was about 20 per cent. less tough, softer, and weaker in compression than the normal-coloured heartwood. The dark material also had a lower specific gravity than the light, this difference being closely correlated with difference in strength.

The dark wood almost invariably showed the presence of mycelium, and it is concluded that the dark coloration, lower specific gravity, and reduced strength of the discoloured samples were due to fungal infection. It was observed that the hyphae had penetrated the cell walls in a manner described as typical for *Poria weirii* [*R.A.M.*, xx, p. 98], but the fungus has not so far been definitely identified. Until further evidence is available the dark coloration is regarded as an incipient stage of rot, possibly accompanied by fungi of the staining type.

RUMBOLD (CAROLINE T.). **A blue stain fungus, Ceratostomella montium n.sp., and some yeasts associated with two species of Dendroctonus.** —*J. agric. Res.*, lxii, 10, pp. 589–601, 4 figs., 1 map, 1941.

A Latin diagnosis and full description are given of a new blue stain fungus, *Ceratostomella montium* [*R.A.M.*, xx, p. 238], disseminated by the bark beetles *Dendroctonus monticolae* and *D. ponderosae*, which infest mountain pines in the central Rocky Mountain forests of the United States. The range covered by the joint attack of the two beetles and the fungus is so far known to extend from the Canadian border in the north to southern Utah in the south, comprising forests in Washington, Idaho, Wyoming, South Dakota, Colorado, and Utah. It is not known whether the fungus is associated with the beetles in other parts of their range. In culture the fungus did not tolerate high temperatures, growing well between 12° and 22° C. with an optimum at 16°. It is concluded, therefore, that the fungus is unlikely to spread far from the mountain forests. The fungus grows in the beetle and larval galleries under the bark and penetrates inner bark and wood, where the bases of perithecia are usually buried, their necks protruding into the galleries like thin black wire. The colour of infected sapwood ranges from grey to blackish green-grey. Young colonies of the fungus in culture are white, changing to warm sepia and black; young hyphae are hyaline, 1·3 to 4 $\mu$ in diameter; old hyphae are brown, septate, 4 to 8 $\mu$ in diameter; conidiophores are single, hyaline, at first simple, later

branched; conidia are hyaline, clustered or solitary, on hyphae and short conidiophores, globular, 4 to 5 $\mu$, ovoid to clavate, 6·5 to 8 by 4 to 5 $\mu$; the perithecia are black, globose, slightly hirsute, with a base 175 to 448 (mean 287) $\mu$ high and 162 to 410 (mean 278) $\mu$ wide and a neck longitudinally striate, 552 to 3,776 (mean 1,527) $\mu$ in length, 21 $\mu$ broad at the tip, and without ostiolar cilia; the asci ephemeral, clavate or ellipsoid; and the eight ascospores unicellular, hyaline, rectangular-parallelepipedal with square ends, 3·7 to 5·8 (mean 4·6) $\mu$ by 2·0 to 3·4 (mean 2·7) $\mu$.

Besides *C. montium*, two yeasts, a fungus of the anascosporous mycelium-forming group and *Zygosaccharomyces pini* were found to be carried by the beetles.

Scheffer (T. C.), Wilson (T. R. C.), Luxford (R. F.), & Hartley (C.). **The effect of certain heart rot fungi on the specific gravity and strength of Sitka Spruce and Douglas-Fir.**—*Tech. Bull. U.S. Dep. Agric.* 779, 24 pp., 3 figs., 3 diags., 7 graphs, 1941.

A detailed study was undertaken in 1918 by the Division of Forest Pathology of the United States Department of Agriculture with the help of the Forest Products Laboratory on the effect of several decay fungi on the strength properties of infected Sitka spruce [*Picea sitchensis*] and Douglas fir (*Pseudotsuga taxifolia*) trees. The early stages of decay by *Polyporus schweinitzii* [*R.A.M.*, xix, p. 445] is marked by few visible symptoms; it is characterized by yellowish longitudinal streaks in the beginning, followed somewhat later by a light brownish discoloration, and finally the wood breaks up into cubical masses. The early stages of *Fomes pini* [*ibid.*, xix, p. 506] decay show reddish-brown discoloration, while later on the typical white pockets develop. The progress of strength reduction by *P. schweinitzii*, and similarly by *F. laricis* [ibid., xiv, p. 205], is not indicated by any sharp changes in the gradation of colour or other visible symptoms and there is little correlation between the appearance of the wood and the degree of decay or loss of toughness, while in the case of *F. pini* the appearance of white pockets marks a very definite stage and the extent of pocket formation definitely indicates the degree of loss of toughness. The initial effects of decay by *P. schweinitzii* were greater than those by *F. pini*, particularly on the toughness of the wood. Shock resistance tests indicated that a reduction in toughness of approximately 20 per cent. can be expected in Sitka spruce as a result of initial infection by *P. schweinitzii*, while the incipient stage of *F. pini* decay would show a reduction not much greater than 10 or 15 per cent., and one of 10 to 25 per cent. only when the pockets are formed. Specific gravity was not greatly affected in the early stages of *F. pini* decay, whereas in the case of *P. schweinitzii* there was a uniform decrease in specific gravity from the zone of earliest to that of greatest decay, although the whole kept well within the range of normal variations of specific gravity. Average reductions by *P. schweinitzii* in the most severely attacked wood were about 10 per cent. in specific gravity, 30 per cent. in maximum crushing strength in compression parallel to grain, and 95 per cent. in toughness, the corresponding figures for *F. pini* in the late pocket stage being about 30, 70, and 95 per cent. respectively.

It is concluded from these results that a study of the effect of one fungus on the several properties and the effect of a second fungus on a single property does not form a reliable basis for estimating the effect of the latter fungus on the other properties. The effect of the fungi seemed greater in wood tested in the green condition than when dry wood was used, but the differences were not very large. While wood badly decayed by *F. pini* and *P. schweinitzii* was inferior in strength, sound wood close to an infected area was normal in strength properties. It thus appears that large parts of somewhat decayed trees may be safely used even where strength is of high importance provided that the limits of decay in those trees are established. The analysis of variability seems to indicate that there is a tendency towards a greater coefficient of variation in toughness as a result of decay by all three fungi studied, although in the case of *P. laricis* this tendency is not apparent further than the outermost zone of decay, the variability in the deeper rotted parts, while greater than in the sound wood, being considerably less than in the marginal decay.

In view of the fact that the large reduction in strength, and particularly shock resistance, caused by *P. schweinitzii* even in its early stages is not indicated by any external change of appearance in the wood, it is suggested that some method, possibly a staining test, should be evolved for the detection of decay. The toughness test used in the present study is recommended for the selection of suitable wood where maximum strength is essential. In this test the specimen block is broken in bending by a single impact applied by a pendulum machine, in which the pendulum is released from a predetermined angle and the angular position to which it swings after the specimen is broken is read from a graduated arc; from these known angles the heights of the centre of gravity of the pendulum assembly before release and after breaking the specimen are found, and the difference between these heights multiplied by the weight of the assembly represents the energy absorbed by the specimen and is the value on which the comparisons between sound and infected wood are based.

Gibson (A. J.). **Wood and its preservation by means of paint and varnish.** —*Emp. For. J.*, xx, 1, pp. 39–49, 1941.

After concisely reviewing the history of the use of paints and varnishes from the earliest times, the author discusses the raw materials used in their manufacture, and concludes with brief recommendations for painting and varnishing wood.

Conard (A.). **Sur la germination des spores de Coniophora cerebella.** [On spore germination in *Coniophora cerebella*.]—*C.R. Soc. Biol., Paris*, cxxxiv, 6, pp. 269–270, 5 figs., 1940.

In laboratory experiments at the Jean Massart Experimental Garden, Brussels, a fragment of a thoroughly desiccated fructification of *Coniophora cerebella* [*C. puteana*] gave rise to conidia, a small number of which germinated after 14 hours in daylight. The formation of the first germ-tube is succeeded by that of another in a diametrically opposite position. The hyphae are septate, profusely branched, and form numerous anastomoses; crescent-shaped, usually bicellular conidia are

produced at the tips of the branches, their numbers amounting to thousands by the end of 20 days, and germinate immediately at one or both extremities in cultures enriched with sawdust.

Walker (J. C.), McLean (J. G.), & Jolivette (J. P.). **The boron deficiency disease in Cabbage.**—*J. agric. Res.*, lxii, 10, pp. 573–587, 6 figs., 1941.

In greenhouse experiments in Wisconsin, young cabbage plants grown in sand-nutrient cultures rapidly developed symptoms of boron deficiency [*R.A.M.*, xvii, p. 717] such as leaf distortion, early death of the growing point, and general stunting. In soil, both in the greenhouse and the field, the deficiency symptoms developed more slowly and field-grown cabbage plants often showed no external signs of disease. The chief internal symptom was a breakdown of the pith, which was, however, more frequent in cauliflower than in either cabbage, kale, collard (*Brassica oleracea* var. *viridis*), or sprouting broccoli. In varietal tests of cabbage, the early-maturing Golden Acre and Resistant Detroit showed the greatest amount of internal breakdown. The disease was greatly reduced in cabbage by the application of 20 lb. borax per acre but complete elimination could not be achieved even by applications of 60 lb., while the more susceptible cauliflower was completely healthy after a 40-lb. treatment. The borax treatment remained effective in the second successive cabbage crop without a further application. Soil treatment with salts of manganese, copper, iron, zinc, and sodium had no effect upon internal breakdown.

Woodman (R. M.). **The nutrition of Lettuces grown as sand cultures under glass. The nutrition of Turnips. The nutrition of the Spring Cabbage.**—*Ann. appl. Biol.*, xxvii, 1, pp. 5–16, 1940; xxviii, 1, pp. 1–7, 1 pl.; 3, pp. 12–188, 1 pl., 1941.

This is a series of three papers dealing with the responses of lettuce, turnip, and cabbage to applications of nitrogen, phosphorus, potassium, boron, calcium, and magnesium, giving the symptoms induced by deficiencies of these elements and the effects upon yield.

Baylis (G. T. S.). **Fungi which cause pre-emergence injury to garden Peas.**—*Ann. appl. Biol.*, xxviii, 3, pp. 210–218, 1 pl., 2 graphs, 1941.

Pea seeds sown during 1937–8 in the field were found to succumb to a pre-emergence attack by fungi, the period of maximum susceptibility being in the early stages of germination, even before the embryo had broken through the seed coat. The seedling axes yielded almost exclusively species of *Pythium*, whilst isolations from the cotyledons included *Ascochyta pisi*, *Pleospora* sp., *Fusarium* spp., and other fungi. Of the isolates tested only species of *Pythium* and a species of *Fusarium* were capable of inhibiting emergence in sterilized soil under conditions compared with those obtaining in the field, while *A. pisi* and *Pleospora* sp., which were probably responsible for reduced emergence of Pilot peas in the field in 1937, exercised little or no effect. The disease is therefore attributed principally to species of *Pythium*. These did not differ widely in pathogenicity and were conidia-bearing strains with the

exception of two which developed sexual organs and are referable to *P. de Baryanum* and *P. ultimum.*

CROSIER (W.) & HEIT (C. E.). **Response of germinants from Beans, Corn, and Peas to seed treatments with hormones and mercurials.**—*Proc. Ass. Off. Seed Anal. N. Amer. 1940*, pp. 88–92, 2 graphs, 1941.

During the routine germination of unselected stocks of seeds of dry shell and snap beans [*Phaseolus vulgaris*], maize, Lima beans [*P. lunatus*], and peas indole-acetic acid, indole-butyric acid, and α-naphthalene-acetamide [*R.A.M.*, xx, p. 521] (0·1 per cent., as 'rootone') were dusted on the dry seeds immediately before these were placed in the germinators, the hormones being suspended in an inert carrier having an adherence rate of about 2 oz. per bush. Ceresan was also included in the tests.

The results obtained showed that with peas, 'rootone' gave 48·1 per cent. seeds or seedlings infected with *Rhizopus nigricans*, 18·2 with *Penicillium* spp., and 20·9 per cent. with bacteria, whilst the corresponding percentages for ceresan were 12·4, 1·7, and 0·8, and for the controls 51·5, 21·8, and 20·6. Similar results were obtained with beans and maize, none of the hormones reducing fungal or bacterial infection. In some instances, α-naphthalene-acetamide increased the percentage of contaminated seedlings.

As measured in percentages of normal sprouts, the response of pea seed stocks to additions of any hormone was negative.

The germination of Lima beans was commonly less for the treated than for the untreated seed. The results from garden beans and maize were inconsistent. The differences in percentages of germination between the hormone-treated and the untreated seed were not significant.

MURPHY (D. M.). **Bean improvement and Bean diseases in Idaho.**—*Bull. Idaho agric. Exp. Sta.* 238, 22 pp., 11 figs., 1940. [Abs. in *Exp. Sta. Rec.*, lxxxv, 1, p. 71, 1941.]

Several strains of the Great Northern bean [*Phaseolus vulgaris*] variety resistant to common mosaic have been developed at the Idaho Agricultural Experiment Station, and the latest release, Great Northern U.I. 15, is also resistant to curly top [*R.A.M.*, xviii, p. 296], while two new selections of Red Mexican, U.I. 3, and U.I. 34, likewise combine resistance to both viruses. Data are presented showing the percentages of common and yellow bean mosaics and curly top and the length of the growing season in several Great Northern selections. The symptoms of bean diseases of importance in the State, where seed and dry bean production is a major industry, are described and control measures recommended.

HARTER (L. L.) & ZAUMEYER (W. J.). **Differentiation of physiologic races of Uromyces phaseoli typica on Bean.**—*J. agric. Res.*, lxii, 12, pp. 717–731, 3 pl., 1941.

Twenty physiologic races of bean rust, *Uromyces phaseoli typica* [*U. appendiculatus*: *R.A.M.*, xx, p. 43], were distinguished in the greenhouse on seven differential host varieties, namely, U.S. No. 3, a white-seeded

Kentucky Wonder type; Bountiful No. 181, a garden bean of the bush type; a strain of California Small White, No. 643, a field bean; a strain of Pinto, No. 650, a speckled field bean; a selection, No. 765, from the Kentucky Wonder Wax variety; a medium-late white-seeded Kentucky Wonder hybrid, No. 780; and a brown-seeded Kentucky Wonder hybrid No. 814, from material received or collected from several localities in the United States and the Hawaiian Islands. Race 5 seemed to be more prevalent and more widely distributed than most of the others. Generally, bean rust appeared to be limited in its distribution to regions with a relative humidity of not less than 95 per cent. for 8 to 10 hours at the time when viable conidia are present. The degree of infection was found to be influenced by light, heat, and length of day. Thus, a grade 1 infection on a scale ranging from 0 to 10 in the winter months would often become grade 2 or 3 on certain varieties inoculated in the spring or autumn. Brown, necrotic lesions varying greatly in shape and size characteristically developed on the under side of the leaf of resistant plants about three days after inoculation, whereas the small flecks, which later develop into large pustules, appeared on more susceptible plants only after about five days. It was thus possible to determine resistant plants before any visible symptoms appeared in susceptible varieties. In varietal resistance tests with races 1 to 14, field beans appeared generally more susceptible to most races than the garden varieties, with the exception of race 10, to which the opposite applied. For each race there were a few varieties highly resistant or immune, so that at least one parent could be found for breeding disease-resistant varieties. It was observed that two or three races may be present in one locality during a single year, but they did not necessarily recur in succeeding years and were sometimes replaced by entirely different ones. Usually one race was greatly predominant over the others. Uredospores remained viable for as long as two years if the leaves were dried for a few days at room temperature and then stored at −20° C.

Parris (G. K.) & Matsuura (M.). **A second strain of Bean rust in Hawaii.**—*Plant Dis. Reptr*, xxv, 11, pp. 311–312, 1941. [Mimeographed.]

The bean [*Phaseolus vulgaris*] varieties Lazy Wife, Rust Resistant-Morse's 191, Kentucky Wonder Brown Seeded Rust Resistant, and Kentucky Wonder Rust Resistant Brown Seeded, previously considered as resistant to rust (*Uromyces phaseoli typica*) [*U. appendiculatus*: *R.A.M.*, xviii, p. 366 and preceding abstract] in Hawaii have now been ascertained to be susceptible, showing that a second form or strain of the fungus is now present. A list is given showing the reactions of 35 bean varieties to infection in Hawaii in 1941 and 1938.

Whitaker (T. W.) & Pryor (D. E.). **The inheritance of resistance to powdery mildew (Erysiphe cichoracearum) in Lettuce.**—*Phytopathology*, xxxi, 6, p. 534–540, 2 figs., 1941.

An account is given of the writers' studies in southern California on the inheritance of resistance to powdery mildew (*Erysiphe cichoracearum*) in the progeny of crosses between the resistant Imperial 850 lettuce and the susceptible wild *Lactuca scariola*. The race of the fungus on *L. scariola*

is characterized by conidia ranging from 33·8 to 63·8 by 18·8 to 31·9 (mean 45·38 by 25·88) $\mu$, the corresponding dimensions for the brown, globose perithecia, hyaline, stalked, more or less elliptical asci, and ovate to ellipsoid ascospores being 124 to 169 by 124 to 169 (137·2 by 137·2) $\mu$, 64 to 86 by 34 to 49 (77·3 by 42·6) $\mu$, and 30 to 45 by 15 to 26 (34·9 by 19·1) $\mu$, respectively.

All the 10 $F_1$ plants tested appeared to be resistant to the disease, and the data obtained from the offspring of the four plants saved indicated the operation of a single dominant gene in the control of immunity. Of the 11 $F_3$ families derived from eight $F_2$ plants, eight were heterozygous, two homozygous-susceptible, and one homozygous-resistant. With one exception the heterozygous families segregated in the expected 3 : 1 ratio, confirming the $F_2$ data in respect of the dependence of resistance on a single dominant gene.

Cook (H. T.). **Late blight of Celery in Virginia.**—*Plant Dis. Reptr*, xxv, 11, pp. 311, 313, 1941. [Mimeographed.]

In 1940, following cool weather which persisted until late in the season, *Septoria apii* became very destructive on celery in the Norfolk area of Virginia. No infection occurred on one farm where four-year-old seed was used that had been rejected because of poor germination, while on another farm it was much lighter on plants grown from old than from new seed. Spraying [cf. *R.A.M.*, xix, p. 507] had little effect in checking the disease on plants from new seed, but was effective on plants from old seed. Six growers together submitted about 25 lb. of seed for treatment, which was dipped in water at 118° F. for 30 minutes, and afterwards rinsed in cold water and dried. Treatment had little, if any, adverse effect on germination, and no infection developed (May, 1941) on any farm that used the treated seed, though infection was very destructive on plantings of growers who had neglected to have their seed treated. Two growers who had their seed treated obtained a number of plants from neighbours whose seed had not been treated, and on both these farms only the beds set with the neighbours' plants developed blight. As the treated seed gave no disease in 1941, though planted in fields badly affected a year before, it would appear that *S. apii* was not able to survive in the soil under the climatic conditions that prevailed from July, 1940, to March, 1941.

Wann (F. B.). **Control of chlorosis in American Grapes.**—*Bull. Utah agric. Exp. Sta.* 299, 27 pp., 8 figs., 1941.

This is an expanded, tabulated account of a series of experiments in the control of vine chlorosis conducted in Davis and Weber Counties, Utah, from 1928 to 1940, a note on which has already been published from another source [*R.A.M.*, xx, p. 101]. Temporary recovery followed the insertion of iron ammonium oxalate or citrate, iron phosphate, or iron citrate salts, in the form of ½ gm. capsules, into holes in the bark, or several applications of iron sulphate (10 lb. per 100 gals.), but the only practicable method of combating the disease with lasting effects is by grafting scions of the widely grown susceptible Concord (American labrusca) variety on European vinifera stocks, e.g., Rose of Peru, Tokay, Muscat, and Malaga, the chlorosis ratings of grafts on which in recent

tests, taking 0 to represent complete freedom from the trouble, were 0·07, 0·30, 0·13, and 0·38, respectively.

HULPOI (AURELIA). **Câteva boale criptogamice noi apărute în anul 1939 în România.** [Some cryptogamic diseases appearing for the first time in the year 1939 in Rumania.]—*Viăța agric.*, xxxi, 5, pp. 134–138, 5 figs., 1940.

Descriptions are given of the symptoms of three diseases observed for the first time in Rumania during 1939, viz., leaf mould of tomato (*Cladosporium fulvum*), shot hole of plums (*Clasterosporium carpophilum*), and *Cylindrosporium castanicolum* (the imperfect stage of *Mycosphaerella maculiformis*) [*R.A.M.*, xviii, p. 355] on sweet chestnuts, together with observations on the life-histories of the causal organisms and directions for their control.

**N.S.W. Department of Agriculture. Biological Branch—Division of Science Services. Plant disease survey for the twelvemonth period ending 30th June, 1941. Eleventh Annual Report.**—30 pp., 1941. [Mimeographed.]

This valuable survey of the diseases affecting economic and ornamental crops in New South Wales has been compiled by officers of the Plant Pathological Section, Biological Branch, Department of Agriculture, from information accumulated during the year ending 30th June, 1941. A number of the more important records have already been noted from other sources [cf. *R.A.M.*, xx, p. 342 and next abstracts].

**Plant diseases. Notes contributed by the Biological Branch.**—*Agric. Gaz. N.S.W.*, lii, 7, pp. 369–371, 384, 3 figs.; 8, pp. 435–438, 5 figs., 1941.

Two of the most serious gladiolus diseases in New South Wales are scab (*Bacterium marginatum*) [*R.A.M.*, xix, p. 22] and hard rot (*Septoria gladioli*) [ibid., xx, p. 20], notes on the symptoms and control of which are given.

All growers of early-sown maize in coastal districts and all maize-growers in tableland areas are strongly advised to dust their seed with agrosan or ceresan (2 oz. per bush.), preferably a few days before sowing, in order to prevent defective germination and seedling blight [*Gibberella fujikuroi* and its var. *subglutinans* and *G. saubinetii*].

Stone fruit-growers are reminded that pre-blossom application of a fungicidal spray not only controls leaf curl [*Taphrina deformans*: ibid., xix, p. 549; xx, p. 244], but is also of value against rust [*Puccinia pruni-spinosae*: ibid., xix, p. 418; xx, pp. 195, 369], freckle [*Cladosporium carpophilum*: ibid., xix, p. 69], and brown rot [*Sclerotinia fructicola*: ibid., xix, p. 550]. Considered purely as a fungicide, Bordeaux mixture (6–4–40) is the best material, but if a spray is required that also possesses insecticidal properties, lime-sulphur (1 in 10 to 1 in 20) should be used. Either white or pale spraying oil may be used in combination with Bordeaux mixture, but only the latter can be employed with lime-sulphur. The inclusion of a small amount of either oil (generally ½ to ¾ gal. per 100 gals. spray) enhances the fungicidal value of Bordeaux mixture.

During the 1940–1 season, boron deficiency symptoms reappeared on some blocks of pear trees in the northern tablelands. Soil treatments with borax [see below, p. 585] had been made in the autumn of 1937, but in the cases noted internal cork and surface cracking reappeared. Growers who failed to apply borax soil treatment during the current season may resort to spraying.

New records included *Alternaria herculea* [*A. brassicae* (Berk.) Sacc.] causing leaf spot of turnips, and *Sclerotinia sclerotiorum* on jute (*Corchoris capsularis*), sunn-hemp (*Crotalaria juncea*), and hemp.

**Annual Report, Cawthron Institute, Nelson, New Zealand, 1940.**—38 pp., [? 1941].

The sections of this report dealing with fruit and tobacco research (pp. 17–28) at the Cawthron Institute, New Zealand, in 1940 contain the following items of interest. A definite response to the use of different magnesium compounds applied as top dressings was obtained in several apple orchards affected with magnesium deficiency [*R.A.M.*, xx, p. 68]. The condition was also controlled by the injection of magnesium sulphate solution into affected Jonathan, Cox's Orange, and Sturmer trees. With Cox's Orange, for example, an injection of 0·84 gm. magnesium gave 0·45 per cent. magnesium oxide in leaf dry matter, with no symptoms of deficiency, one of 0·5 gm. gave 0·3 per cent. magnesium oxide with a very slight trace of deficiency, one of 0·42 gm. plus 0·54 gm. calcium (as acetate) gave 0·19 per cent. magnesium oxide with fairly severe deficiency symptoms, and one of 0·25 gm. plus 0·32 gm. calcium gave 0·18 per cent. magnesium oxide with a small amount of deficiency. The control, into which distilled water was injected, showed 0·14 per cent. magnesium oxide in leaf dry matter, with very severe deficiency. A soil dressing of ground limestone at the rate of 24 lb. per tree increased the severity of magnesium deficiency symptoms. Taken as a whole, the results so far obtained show that marked benefit has resulted from the use of magnesium compounds, especially magnesium carbonate and sulphate, but that commercial control has not yet been achieved.

Soil top-dressings of borax (½ and 1 lb. per tree) again increased internal breakdown in Jonathan apples, but less so than in earlier experiments [ibid., xix, p. 604]. Borax applications continue to give satisfactory control of apricot brown spotting [ibid., xix, p. 30], while cherry trees treated with borax have remained free from 'pitting' trouble, though untreated trees are affected.

Applications of magnesium carbonate (100 lb. per acre) and burnt dolomite (250 lb. per acre) controlled tobacco sand drown (or magnesium deficiency) [ibid., xvi, p. 637], which adversely affected yield and leaf quality, and increased the magnesium oxide of the leaf samples to 0·33 and 0·12 per cent., respectively, compared with 0·09 per cent. in the control. The condition was present in several areas.

Nattrass (R. M.). **Plant diseases in Kenya during 1940.**—*E. Afr. agric. J.*, vii, 1, p. 57, 1941.

During 1940, the following new disease records were made in Kenya. Carrots in the Sotik area became infected by a fungus agreeing with

*Macrosporium carotae* [*R.A.M.*, ii, p. 6; xix, p. 517]; the disease has not been reported from elsewhere in East or from South Africa. *Elsinoe phaseoli* [ibid., xviii, p. 58] caused serious infection of *Phaseolus aureus*, attacking the leaves, stems, and pods. Papaws in one plantation developed a black, leathery rot due to *Ascochyta caricae* [ibid., xvii, p. 259; xx, p. 152]. The rot was distinguished from that caused by *Gloeosporium* sp. by the closely aggregated pycnidia from which, under moist conditions, white spore tendrils protrude. The spores (mostly bicellular, with one cell often larger than the other) measured 8 to 11 by 3 to 4 $\mu$. Many pycnidia contained only unicellular spores, but typical *Ascochyta* spores developed later.

A serious disease attacked many of the *Stapelia* species in Nairobi, beginning as deeply sunken lesions up to 1 cm. in diameter, which rapidly became confluent. The aerial parts turned black and shrivelled up. The bottom of each cavity was covered with cespitose, completely immersed pycnidia without a stroma, measuring approximately 150 by 125 $\mu$ in diameter, and more or less wide open at maturity. The uni- to biseptate spores measured 40 to 60 by 3 to 4 $\mu$. The fungus is considered to be a hitherto undescribed species of *Phleospora*.

A large proportion of die-back and crown rot in a commercial lavender planting was associated with a species of *Phomopsis*, though the primary cause of the disease is believed to be a splitting of the crown and main branches.

*Melanospora parasitica* [ibid., xii, p. 216] occurred on *Cephalosporium* sp. attacking *Pseudococcus kenyae*.

*Oidiopsis taurica* caused a leaf spot of *Tropaeolum* sp., and *Verticillium dahliae* a wilt of eggplant.

A further physiologic race (K6) of wheat stem rust [*Puccinia graminis*] appeared on Reliance wheat, hitherto susceptible only to K3 [cf. ibid., xix, p. 76].

THOMPSON (A.). **Notes on plant diseases in 1940.**—*Malay. agric. J.*, xxix, 6, pp. 241–245, 1941.

Two of the more important fungi associated with leaf base and stem tissue decay in felled oil palms are *Fomes noxius* and *Ganoderma applanatum* var. *tornatum* [*R.A.M.*, xx, p. 7]. The latter has not been definitely observed as an agent of disease in standing palms, but in view of its apparent relation to a stem decay of palms 'replanted' by felling after cutting the roots on the 'off' side of the stem, its further activities will be watched. Young palms growing in nutrient solutions without nitrogen develop yellowing; without magnesium, chlorosis and browning are followed by death; and without potassium yellowing is accompanied by brown scorch of the tips of the pinnae.

*Marasmius palmivorus* [ibid., xvii, p. 162] was responsible for an outbreak of leaf disease in dwarf coco-nut palms during the heavy rains in Lower Perak in the last quarter of 1940. Treatment consisted in the pruning of the affected foliage, the clearance of debris from the crown, and improvement of the drainage system. The greater humidity in the crown region and the earlier accumulation of debris therein in dwarf as compared with tall palms probably account for the susceptibility of the former to *M. palmivorus*.

A cracking of the bark of young areca nut stems on the side facing west during a protracted drought, followed by a black rot of the inner tissues extending for several feet up and down the stem, is tentatively attributed to sun scorch, aggravated by the dry weather, *Pestalozzia* sp. and *Thielaviopsis* sp., isolated from the infected parts, having given negative results in inoculations.

A *Piricularia* similar to *P. oryzae* causing severe leaf spot of *Eleusine coracana* [ibid., xix, p. 259] at Serdang failed to infect rice in cross-inoculation tests.

*Coix lacryma-jobi* was heavily infected but little damaged by *Phyllachora coicis*.

**Fifty-third Annual Report of the Kentucky Agricultural Experiment Station for the year 1940. Part I.**—67 pp., 1941.

In this report on plant disease work in Kentucky in 1940 [*R.A.M.*, xix, p. 678] it is stated that nine strains of Burley tobacco tested on 500 farms were found to be highly resistant to mosaic, to make good growth, and to produce satisfactory cured tobacco; all, however, were unsuitable for general planting. Other new strains with Ambalema type of resistance and almost identical with Ky 16 should prove more satisfactory than the strains so far tested.

In 103 fields tended by men who used barn-cured tobacco, mosaic infection ranged from 2 to 96 per cent. of all the plants, and averaged over 20 per cent. In 39 fields where the workers did not use barn-cured tobacco infection was present in 1 per cent. or under of the plants in 27 fields, while only in two fields did the figure reach even 8 per cent.

Of six distinct strains of tobacco ring spot, five caused bleaching; the sixth induced chlorosis and necrosis of new leaves when the temperature was reduced to about 20° C. After the inoculated plants had passed the ring spot stage of the disease, conspicuous chlorosis and, sometimes, necrosis developed on plants infected by five of the strains, whenever the temperature was reduced to about 20°. These results and the fact that all strains cause some pollen sterility are considered to prove that tobacco plants infected by ring spot do not recover and cannot be regarded as having developed immunity.

*Cercospora nicotianae* [ibid., xx, p. 181] was isolated from 405 of 423 green spots on 76 leaves of cured Burley tobacco from as many different farms. A tobacco leaf decoction agar was prepared, on which the fungus sporulated freely. When tobacco leaves were sprayed with the spores through an atomizer and kept in a humid atmosphere, typical lesions developed in 10 to 12 days. If inoculated plants were cut before infection had become visible, green spots appeared while curing was in progress.

Owing to cool weather after setting, black root rot (*Thielaviopsis basicola*) [ibid., xx, p. 88] was unusually injurious to non-resistant strains of tobacco in the dark tobacco areas. Of 272 fields examined, 41 per cent. showed a reduced yield, though Ky 16 Burley grew normally in fields where the local varieties were seriously affected.

Black shank (*Phytophthora parasitica* var. *nicotianae*) [ibid., xx, p. 187] was observed in central Kentucky for the first time. In Georgetown, infection seems to have occurred first in 1932, on a plot on which

sweepings from a seed and fertilizer warehouse had been scattered. The fungus was carried to other plantings by machinery used on the land. Owing to the long rotations used locally, spread of infection will probably be slow.

Much of the land planted to tobacco in western Kentucky was found to be low in available potassium; this causes leaf conditions which are often confused with bacterial leaf spot. In many fields, potassium starvation was associated with soil rendered almost neutral by liming. Frenching was found in 11 fields.

Tomatoes sprayed twice with yellow copper oxide (3 lb. per 100 gals. of water) gave better growth than others sprayed twice with Bordeaux mixture (4–4–50), though no difference was noted in the amount of disease [unspecified] developing on the foliage.

In the sixth year of inspection, no phony peach [ibid., xviii, p. 323] was found. The only county where an infected tree has been found in the past three years is Webster, where one was discovered in 1939.

**Plant pathology.**—*Rep. Fla agric. Exp. Sta., 1939–40,* pp. 105–120, 1 fig., [? 1941].

This report on plant disease work in Florida in 1939–40 [cf. *R.A.M.*, xviii, p. 788] contains the following items of interest. A. H. Eddins states that the loss from potato bacterial ring rot [*Bacterium sepedonicum*: ibid., xx, p. 520] in the Hastings area was estimated at 0·5 per cent., and was almost entirely confined to 1,000 acres planted with selected seed reported to show a trace of infection in Maine. In the remaining 11,000 acres planted with certified seed, the disease was found in only two fields. No infection developed in plants originating from clean seed grown in soil 'seeded' with affected tubers in 1938, and none was observed in the progeny of tubers produced in this infested soil in 1939. The condition was not transmitted from affected plants in one row to healthy plants in adjacent rows. Spread from the cutting knife was prevented by treatment with mercuric chloride solution (1 in 1,000 for 5 minutes), or formalin (40 per cent. diluted 1 in 15 for 10 minutes or 1 in 30 or 60 for 15 minutes).

There was no significant reduction in the total yield of Katahdin potato tubers in plots containing not more than 32 per cent. spindle tuber [ibid., xx, p. 221], but in plots 100 per cent. affected the average yield was 52·7 bush. per acre less than that in healthy plots.

Seedling isolations demonstrated that *Rhizoctonia* may be one of the most important factors determining initial stands of watermelons, while three species of *Pythium* were also isolated [ibid., xx, p. 343], and *Colletotrichum lagenarium* [ibid., xix, p. 190] was present to a slight extent.

In further tests by A. S. Rhoads, *Armillaria mellea* and *Clitocybe tabescens* [ibid., xviii, p. 789; xx, p. 68] were grown in culture at $P_H$ values from 4·2 to 7·1. After six weeks, the average amount of growth was about the same in all series. Most of the *C. tabescens* cultures developed masses of embryonic sporophores, though *A. mellea* in no instance showed any fruiting. Recent commercial plantings of Jewel peaches showed serious root rot due to *C. tabescens*. Infection appeared when the plantings were two years old, the number of trees attacked

increasing rapidly with age. A total of 154 different hosts have so far been found infected in Florida. By the end of May, 1940, five of the 16 *Casuarina equisetifolia* trees experimentally inoculated with *C. tabescens* in November 1938 and two of the controls were completely girdled and dead.

Observations by W. B. Tisdale and G. D. Ruehle showed that many lime trees [*Citrus aurantiifolia*] became chlorotic and unthrifty before there were any signs of invasion of the bark and wood by *Diplodia* sp. [cf. ibid., xiv, p. 86] and *Phomopsis* sp. These trees showed constricted lines or patches in the bark, and underneath such areas the wood was discoloured and gummy. In 1939, 30 buds from affected trees were placed on rough lemon seedlings. Of the 21 that grew, only one appeared healthy in January, 1940. This chlorotic condition appears to be due to a virus and to be transmitted through the budwood.

Data obtained by K. W. Loucks showed that of numerous vine varieties Madeline Angevine was least susceptible to black rot [*Guignardia bidwellii*: ibid., xix, p. 25] and Urbana to bitter rot [*Glomerella cingulata*: ibid., xvi, p. 17]. With both diseases, the rootstock used made no appreciable difference to susceptibility, except in the case of Niagara, which was most susceptible to the former disease on Beacon and least so on Herbemont and Lukfata, while it showed 89 and 39 per cent. bitter rot on Lukfata and Champinii, respectively.

A. N. Brooks states that frost injury to celery facilitated infection by *Sclerotinia sclerotiorum* [ibid., xx, p. 4], while low temperatures stimulated the development of apothecia and ascospores. In fields treated neither by flooding nor by cyanamide application crop loss reached 35 per cent., while where flooding alone was used the figure was 10 per cent., and where both flooding and cyanamide treatment were adopted, 5 per cent.

**Annual Report of the Agricultural Experiment Station, Río Piedras, Puerto Rico, 1938–39.**—99 pp., 13 figs., 9 graphs, [? 1940]; **1939–40.**—66 pp., 11 figs., [? 1941].

Among the numerous items of phytopathological interest included in the first report, the following may be mentioned. Bananas and plantains showing symptoms of 'twisted top' [*R.A.M.*, xvi, p. 114] at an early stage of growth were observed by M. T. Cook and A. R. Lopez to reach maturity in a normal way and bear fruit, while suckers from the affected plants developed without signs of the trouble. Similar results were obtained with suckers from bunchy top plants. The same workers state that banana leaf spot (*Cercospora musae*) has only recently begun to appear in a severe form in the Island, especially on the Dwarf Montecristo variety on unduly exposed sites. Good control was obtained in an experiment at San Sebastián by the removal and destruction of the lower, heavily infected leaves, followed by the application of 4–4–50 Bordeaux mixture to the remainder of the foliage, but the expense of this treatment would be too great for commercial use and the development of resistant varieties is regarded as the only practicable measure of control.

A burning of yam [*Colocasia esculenta* and *C. antiquorum*] foliage in experimental plots was tentatively attributed to the effects of Bordeaux

mixture, but the same condition developed naturally in six varieties. A species of *Fusarium* with a white mycelium was isolated from the roots and stem bases of dead yams near San Germán, where a patch of some 2,000 in a large plantation were affected.

A. Roque's experiments showed the new Río Piedras Station strains of cucumber, 39 and 40, which are resistant to downy mildew [*Pseudoperonospora cubensis*], to be much better yielders than the commercial varieties Black Diamond and Early Fortune, the total yields in cwt. per acre of the four sorts (in the order named) being 181·7, 180·6, 132·8, and 105·7, respectively, and the corresponding percentages of marketable fruit 57·4, 57·3, 39·9, and 32·8, respectively. In this series of tests the new strains were not sprayed against the disease, while the commercial varieties received eight applications of Bordeaux mixture. The cost of combating *P. cubensis* on susceptible varieties ranges from $30 to 50 per acre, and it is estimated that a complete replacement of those now under cultivation by the new resistant selections would represent an added annual revenue to growers of $50,000.

Serious damage to the Puerto Rican [chilli] pepper crop is caused by a mosaic disease stated by A. Roque and J. Adsuar to be due to a virus quite distinct from that of tobacco mosaic, responsible for a similar disease in the United States. The small, native, mild peppers used for seasoning food are highly susceptible to infection under local conditions, and probably serve as the chief sources of dissemination, while one of the indigenous hot types is very resistant and may provide suitable material for breeding trials.

P. R. Kuntz has developed a new sugar-cane variety, PR–900, combining vigorous growth with freedom from arrowing and immunity from mosaic and gumming [*Xanthomonas vasculorum*].

In the second report, L. A. Alvarez states that inoculation tests failed to demonstrate the pathogenicity to coffee of *Rosellinia bunodes* [ibid., xvi, p. 778]. A species of *Fusarium*, however, isolated from diseased material, was found to cause severe wilt under favourable conditions. The disease was most prevalent in medium-wet soils, at $P_H$ values 4·53 to 5·57.

Cassava was attacked by *Gloeosporium manihotis* [ibid., xii, p. 680]. Small, light green spots appeared on the leaves, and enlarged rapidly under moist conditions until they covered a great part of the leaf. Affected stems and twigs died back.

In a comparative test by A. Roque, unsprayed cucumbers of varieties 39, 43, 40, and 37, resistant to mildew [*Pseudoperonospora cubensis*: see above] yielded, respectively, 176·8, 150·4, 147, and 132·8 cwt. per acre, as against 111 and 95·2 cwt., respectively, for the commercial varieties Black Diamond and Early Fortune, when sprayed with Bordeaux mixture (2–2–50), and 50·8 and 29·6 cwt. for the same varieties, respectively, when unsprayed. The yield of the varieties, 37, 39, and 40 was adversely affected by spraying.

L. A. Alvarez states that cucumbers in Rio Grande maturing as rainfall became abundant were attacked by 'cottony leak' [*Pythium aphanidermatum*: cf. ibid., v, p. 71]. Characteristic symptoms of mosaic were observed on cucumbers about to be picked; the first lot of fruit gathered was marketable, but the last was much discoloured, and the

surrounding plantations became so severely infected that they had to be destroyed. Cucumbers on arrival in New York were affected by black rot due to a species of *Mycosphaerella*, infected fruits subsequently being noted in the vicinity of Rio Grande. Infection declined at the end of the rainy season.

A. Roque states that in a comparative trial in infected soil the new eggplant varieties Puerto Rican Beauty and E–12, which are highly resistant to bacterial wilt [*Bacterium solanacearum*], showed only 12 and 20 per cent. infection, respectively, as against 68 per cent. for Florida High Bush and 91 per cent. for Black Beauty. Both new varieties gave high yields and fruit of better quality than the commercial varieties.

L. A. Serrano states that in commercial plantings of papaw, 86·6 per cent. of the plants became infected by mosaic [ibid., xviii, p. 808].

N. A. Schappelle points out that many local growers have to spray their pineapple plants with iron sulphate to prevent chlorosis, though the soil in which the plants are growing is rich in iron and manganese. Water culture experiments demonstrated that the plants contain sufficient iron for normal growth, but that the iron from the soil becomes unavailable unless the manganese is rendered ineffective.

Shands (R. G.). **Disease resistance of Triticum timopheevi transferred to common winter Wheat.**—*J. Amer. Soc. Agron.*, xxxiii, 8, pp. 709–712, 1 fig., 1941.

Details are given of hybridization work at the Wisconsin Agricultural Experiment Station culminating in the transference to fertile types of winter wheat (Wisconsin Pedigree No. 2 and Marquis) of various characters proper to *Triticum timopheevi*, including resistance to mildew [*Erysiphe graminis*] and leaf and stem rusts [*Puccinia triticina* and *P. graminis*: *R.A.M.*, xx, p. 54].

Greaney (F. J.), Woodward (J. C.), & Whiteside (A. G. O.). **The effect of stem rust on the yield, quality, chemical composition, and milling and baking properties of Marquis Wheat.**—*Sci. Agric.*, xxii, 1, pp. 40–60, 1941.

Co-operative studies [the results of which are tabulated] carried out at Winnipeg from 1933 to 1937 to determine the effect of stem rust (*Puccinia graminis tritici*) on the yield [*R.A.M.*, xvi, p. 25], quality, chemical composition, and milling and baking qualities of Marquis wheat showed that in 1934, 1935, and 1937 (when the untreated plots became heavily infected and those dusted with sulphur developed a wide range of infection), stem rust alone or in conjunction with leaf rust (*P. triticina*) [ibid., xix, p. 204] markedly affected yield, kernel weight, and commercial grade. In 1937, when leaf rust was not a complicating factor, increase in stem rust from 5 to 90 per cent. reduced the yield by 84 per cent. and the kernel weight by 65 per cent.; the test weight per bush. was reduced by 14 lb., and the commercial grade lowered from 'Manitoba No. 1 Hard' to 'Feed Wheat'. Grain yield and quality were always inversely proportional to the percentage of infection. Of the agronomic factors studied, kernel weight afforded the most accurate index of the extent of stem rust injury.

In each of the same three years the protein content of the grain decreased as the percentage of rust increased, stem rust exerting a marked effect. The phosphorus, calcium, and ash contents of the grain were not significantly affected by rust in 1934 and 1935, but in 1937, all three constituents increased with increased stem rust. On the other hand, it was found that the protein and phosphorus contents of the straw increased, though the calcium and ash contents decreased, with increased stem rust. Increase in stem rust was always associated with a decrease in yield of straight grade flour, loaf volume, and in crumb colour and crumb texture score. The content of yellow pigment (carotene) of the flour increased with increased rust. In all three years, stem rust reduced the milling value of the wheat.

RUSSELL (R. C.) & LEDINGHAM (R. J.). **Wheat seed testing from the pathological standpoint with special reference to embryo exposure.**— *Sci. Agric.*, xxi, 12, pp. 761–775, 1 fig., 2 graphs, 1941.

A full account is given of routine tests made of over 200 samples of seed wheat produced in Saskatchewan to ascertain their suitability for seed purposes. The tests were as follows: (1) visual examination, (2) examination for exposed embryos, (3) centrifuge test, and (4) incubation test. In the first, each sample was examined with respect to colour, plumpness, and indications of disease. In the second, a portion of each sample was placed in a glass tube of small bore, and examined microscopically for cracks or breaks in the pericarp and testa over the embryo. In the third, a portion of each sample (40 gm.) was placed in a flask with 60 c.c. of water and shaken for four minutes, the water decanted, and four 12 c.c. portions centrifuged for four minutes. The supernatant water was again poured off and the remaining water (about ½ c.c.) and sediment examined under the microscope for bunt [*Tilletia foetida* and *T. caries*] spores. In the fourth test, 100 kernels of each sample, previously untreated, were incubated at 24·5° C. for four days, after which the number and kinds of fungal colonies found were recorded. Some of the samples were examined still further in germination tests in pots in the greenhouse, and in germination, yield, and bunt tests in the field.

The results obtained were as follows. The centrifuge test revealed very little apart from the presence of bunt spores on about one-third of the samples. When some of these samples were sown in the field it was found that a trace of bunt spores on the seed sometimes resulted in a trace of bunt in the mature crop, and in about an equal number of cases did not. More numerous bunt spores on the seed gave heavier infections in the mature crop. Under Saskatchewan conditions, seed treatment against bunt should be carried out whenever the seed shows a trace of the spores, but not unless. About two-thirds of all the seed samples tested showed no trace of bunt, and only very few revealed any appreciable infection by *Helminthosporium sativum*.

The incubation test showed that a large proportion of the seed carried *Alternaria* spp. and other fungi, including *H. sativum*, *Fusarium* spp., *Rhizopus nigricans*, *Cladosporium* sp., and *Penicillium* spp.

Critical examination for cracks and holes in the seed coat showed that about 25 per cent. of all the kernels examined had their embryos

more or less completely exposed to the action of fungi and fungicides. Emergence of a sample was generally reduced when a large proportion of the seeds had the embryos exposed, such reduction being due to mechanical destruction of parts of the embryos, direct poisoning by the unobstructed penetration of fungicides, parasitic attack on the developing seedling, or the presence of saprophytes on the endosperm. Both greenhouse and field tests showed that formalin treatment is particularly apt to damage seeds with exposed embryos, whereas ceresan had a beneficial effect in greenhouse tests but caused slight or no consistent improvement in field tests. Reduced emergence was not invariably followed by reduced yield. In some cases the thinner stand was able to utilize all the available moisture and produce as much grain as the thicker stand. In other instances, however, reduced emergence resulted in distinctly smaller yields, and this would probably apply to weedy fields. Where much embryo exposure is present the rate of seeding should probably be increased.

Sandu-Ville (C.) & Hulpoi (Aurelia). **Resistența câtorva soiuri de Grâu la infecțiunea cu mălură.** [The resistance of some Wheat varieties to infection with bunt.]—*Viăța agric.*, xxxi, 2, pp. 37–40, 1940.

A tabulated account is given of the writers' experiments in 1938–9 at the Agricultural Research Institute, Bucharest, to determine the reaction of 16 wheat varieties to artificial infection with the spores (1 to 5 gm. per kg. seed-grain) of *Tilletia foetens* [*T. foetida*], which is stated to be both more widespread and more virulent under local conditions than *T. tritici* [*T. caries*: *R.A.M.*, xviii, p. 732]. The most resistant variety was found to be Odvoș 241 (average infection 12·99 per cent.), followed by pure line Tighina 265, Hamangia 2–123, Roșu românesc, Bălan, Zemka, and I.C.A.R. 14, with 19·69, 19·70, 21·68, 22·93, 23·26, and 24·77 per cent., respectively, and the most susceptible American 26 (59·67 per cent.).

Szirmai (J.). **Vergleichende Freilandbeizversuche mit Kupfervitriol und Kupferkalkbrühe gegen Weizensteinbrand.** [Comparative field disinfection experiments with copper sulphate and Bordeaux mixture against Wheat bunt.]—*Rep. Hung. agric. Exp. Sta.*, xliii, 1–6, pp. 43–49, 3 figs., 1941. [Hungarian, with German summary.]

In continuation of a previous series of laboratory experiments (*Rep. Hung. agric. Exp. Sta.*, xlii, pp. 1–12, 1939), the writer compared the efficacy of copper sulphate and Bordeaux mixture in 1 and 2 per cent. solutions in the control of wheat bunt [*Tilletia caries* and *T. foetida*: *R.A.M.*, xv, pp. 144, 351], seed-grain of the Bánkuli 1201 variety being immersed in the fungicides for periods of 15 to 30 minutes. Copper sulphate caused a retardation of germination ranging from 48·5 to 61·5 per cent. (or more under adverse conditions), the extent of the injury still amounting to between 4·5 and 25 per cent. in the fifth week. No such ill effects followed the treatment with Bordeaux mixture, which in some cases actually stimulated germination. Bordeaux mixture further proved superior to copper sulphate in promoting resistance to winter injury, density of stand, vigorous growth, and prolific yields, the surplus grain and straw due to the former as

compared with the latter preparation amounting to 13·2 and 16·3 per cent., respectively. The plants developing from the disinfected seed-grain did not suffer from bunt, which occurred in the dry and wet controls to the extent of 8·3 and 5·2 per cent., respectively.

**Ministry of Agriculture and Fisheries. Advisory Leaflets.**—London, H.M. Stationery Office. 1d. each.

In leaflet 304, 3 pp., 1941, a popular description is given of the symptoms and etiology of take-all or whiteheads of wheat and barley (*Ophiobolus graminis*), with directions for its control by crop rotation, barley and wheat being excluded in favour of roots or some other non-susceptible crop for a reasonable period; cultural measures designed to reduce the virulence of the fungus, including (especially on the light-textured soils favouring its development) early ploughing, bastard-fallowing or the interposition of a mustard catch crop, and thorough consolidation of the seed-bed before drilling, which should preferably be deferred until October or November to allow the early autumn rains to contribute to this process; liberal applications of phosphates and nitrogen in the form of sulphate of ammonia, avoiding overdoses of lime; extermination of grass weeds, such as couch [*Agropyron repens*] and slender foxtail [*Alopecurus agrestis*], both frequent carriers of infection; omission of rye grass [*Lolium perenne*] from the temporary ley where the disease has been troublesome, clover alone being sown instead to starve out the pathogen, or in a mixture with timothy [*Phleum pratense*], on which infection is not ordinarily perpetuated; and cultivation of the red wheats, which withstand attacks of take-all better than the white ones.

Revised editions of the following leaflets appeared during 1941: Common scab of the Potato (No. 5), Downy mildew of the Onion (85), Apple and Pear canker (100), Dry rot of Potatoes (218), Spotted wilt of Tomato (238), Tomato leaf mould (263), and Potato leaf roll (278).

Grace (N. H.). **Effects of phytohormone, potassium nitrate, and ethyl mercuric bromide on the germination and early growth of Wheat.**—*Canad. J. Res.*, Sect. C, xix, 6, pp. 211–215, 1941.

The results are given of greenhouse experiments in which Marquis wheat seed-grain was treated with various talc dusts containing indoleacetic acid, potassium naphthylacetate, potassium nitrate, and ethyl mercuric bromide [*R.A.M.*, xix, p. 586]. The last-named retarded the germination rate but increased the final germination count; potassium nitrate interacted with ethyl mercuric bromide, and when used with it reduced final germination and the air-dry weight of young plants. The addition of phytohormone did not affect these results. Phytohormone alone did not markedly affect germination, but on the average dust treatments reduced the rate of germination but increased the air-dry weight of stems.

Tervet (I. W.). **The relative susceptibility of different lots of Oat varieties to smut.**—*Phytopathology*, xxxi, 7, pp. 672–673, 1941.

The percentage of infection developing in 11 lots of Anthony oats seed-grain from four localities in Minnesota as a result of inoculation with collection 96 of *Ustilago levis* [*U. kolleri*: *R.A.M.*, xx, p. 159]

ranged from 14 to 72, the former count applying to 1939, and the latter to 1936 material, both from the University Farm, St. Paul. While a full explanation of these differences in susceptibility has not yet been obtained it was found that rapidity of germination, involving a reduction in the infection period, increased resistance to *U. kolleri*, while light seed-grain, as already shown by Lods and Coulson in Canada [ibid., x, p. 179], gives rise to more susceptible seedlings than larger seed. Results similar to the foregoing were obtained with seed lots of the Rusota, Iogold, and Gopher varieties, while a parallel series of tests with collection 27 of *U. avenae* [loc. cit.] also developed along comparable lines, though the incidence of infection in this case was lower than with *U. kolleri*.

Ling (L.). **Factors affecting infection in Rye smut and subsequent development of the fungus in the host.**—*Phytopathology*, xxxi, 7, pp. 617–633, 2 figs., 2 graphs, 1941.

Continuing his studies at the Minnesota Agricultural Experiment Station on the factors affecting the infection of rye by *Urocystis occulta* and the subsequent development of the smut within the host [*R.A.M.*, xvi, p. 666; xx, p. 297], the writer found that the maximum incidence of attack on the Dakold variety occurred when the inoculated seeds were germinated in soil with a hydrogen-ion concentration of $P_H$ 7·36. The progress of the fungus was expedited by the maintenance of the soil in a relatively dry state (25 per cent. of the water-holding capacity), under which condition the percentages of Rosen plants infected in two experiments were 35 and 26, respectively, compared with 29 and 24, respectively, at 50 per cent. water-holding capacity, and 14 and 19, respectively, at 75 per cent.

In field tests on a poor, sandy soil, the amount of smut was not influenced by the fertilizer scheme, but in sand cultures in the greenhouse solutions with high potassium phosphate and low calcium nitrate and magnesium sulphate contents tended to reduce the amount of smut, while a reversal of these ratios induced the opposite effect. Variations in the intensity of light and the duration of exposure did not significantly affect the incidence of smut in the Prolific (spring) variety, but an extension of daylight from the normal 9 to 11 to between 17 and 18½ hours increased the percentage of infection in the winter Dakold from 39 to 48 per cent., the corresponding amount for the short-day (6 to 8 hours) series being 29 per cent. Smutted plants of Dakold were observed in the field to suffer more severely from winter-killing than healthy ones following the rigorous conditions of 1935–6. At a low temperature (15° C.), precocious germination favoured the infection of Dakold rye by *U. occulta*, the incidence of which in seedlings all emerging within two days of the appearance of the first was 46 per cent. as against 37 per cent., in those coming up slowly and 39 per cent. in unselected seedlings used as a control. Similar relations obtained in a comparative test with Ceres wheat inoculated with *Tilletia levis* [*T. foetida*] (from Mexico) at 10°, the infection percentages in the early, late, and control groups being 61, 39, and 56, respectively [ibid., iv, p. 339]. At higher temperatures, however, rapidity of germination was not a controlling factor in smut or bunt development.

Picric acid, applied to the soil at the rate of 240 mg. per kg., reduced the incidence of *U. occulta* in Dakold rye from 37 to 20 per cent. [ibid., xix, p. 139], but caused the formation of necrotic spots on the leaves and withering of their tips.

Reyes (G. M.). **Notes on diseases affecting Maize in the Philippines.**—*Philipp. J. Agric.*, xii, 1, pp. 61–69, 6 pl., 1941.

In these notes on maize diseases in the Philippine Islands the author states that downy mildew (*Sclerospora philippinensis*) [*R.A.M.*, xviii, p. 444] occasionally causes 100 per cent. infection in some parts. Selection work for resistance is in progress, and of six selections planted, one remained unaffected, while the others showed only 2·7 to 5·4 per cent. infection, as against 7·5 (Cebu White) to 31·5 (Bauan Pula) per cent. for commercial varieties in the vicinity. In the wet season, the plantings made from 15th to 28th May are those least affected, while preliminary observations indicate that plantings made in October and coinciding with the drier months remain unaffected even in the presence of abundant sources of infection.

During 1939–40, the crop was affected by four diseases not previously reported from the Philippines, viz., brown spot (*Physoderma zeae-maydis*) [*P. maydis*: ibid., xiii, p. 691], suspected of being present unnoticed for some time, attracting attention in 1940 by its prevalence and severity; anthracnose due to an unidentified species of *Colletotrichum*; dry ear rot, stated to be quite common and possibly caused by *Diplodia frumenti* [ibid., xvii, p. 670]; and a disease resembling sugar-cane pokkah-boeng, produced by a fungus agreeing essentially with *Fusarium moniliforme* [*Gibberella fujikuroi*]. The last-named disease has been observed occasionally but no record of its occurrence has hitherto been published. When warm, humid weather prevails, maize is occasionally attacked by banded sclerotial disease (*Rhizoctonia* [*Corticium solani*]) [ibid., xviii, p. 626; xx, p. 357], which appears to be of minor importance.

Ramakrishnan (T. S.) & Narasimhalu (I. L.). **The occurrence of Darluca filum (Biv.) Cast. on cereal rusts in South India.**—*Curr. Sci.*, x, 6, pp. 290–291, 2 figs., 1941.

Specimens of sorghum, *Pennisetum typhoides*, and *Setaria italica* infected by *Puccinia purpurea* [*R.A.M.*, xix, p. 331], *P. penniseti* [ibid., vii, pp. 13, 231, 712], and *Uromyces setariae-italicae* [ibid., xv, p. 635], respectively, which were collected in the period from November to January during the last few years at the Coimbatore Agricultural College, frequently bore uredosori parasitized by *Darluca filum* [ibid., xx, p. 395]. The hyperparasite, of which this is stated to be the first record on cereal rusts in India, usually develops only in the later stages of infection, during or following rainy weather, so that its utility in the practical control of the diseases under observation is doubtful.

Morris (H. I.), Klotz (L. J.), & Sokoloff (V. P.). **Brown rot control and copper injury. Report of a field experiment on Lemons.**—*Calif. Citrogr.*, xxvi, 10, p. 284, 1 fig., 1941.

In a fungicide trial in a Californian orchard in 1941, lemon trees

averaging 27 years of age sprayed 'to a four-foot skirt of the trees' with 6–6–100 Bordeaux mixture at the rate of 6·7 gals. per tree, the same at 3·6 gals., and with 1–1–100 Bordeaux mixture at the rates of 6 and 4 gals. per tree showed a reduction in the number of fruits affected by brown rot [*Phytophthora citrophthora*, *P. parasitica*, *P. hibernalis*, and other species: *R.A.M.*, xx, p. 299] from a total of 126·8 per tree for the controls to 12·6, 12·5, 22·2, and 47·1, respectively. In three other plots, which had fewer lemons near the ground within the splashing range of the brown rot zoospores, applications of a commercial 5–1–4–100 zinc-copper-lime mixture at rates of 6 and 3·7 gals. per tree and 2–2–100 Bordeaux mixture at the rate of 4 gals. per tree yielded averages of 19·0, 21·4, and 14·3 diseased fruits per tree, respectively. Heavy applications proved more successful than light ones, particularly with the weaker sprays, the 1–1–100 Bordeaux mixture giving apparently satisfactory commercial control under these conditions. The addition of zinc sulphate was observed to decrease the tendency of the trees to be injured by copper or by the combined effects of copper and fumigation. Long, continuous periods of rainy weather are held responsible for copper burns, as the accumulation of carbon dioxide on moist plant surfaces is said to favour the solution of copper to concentrations that are corrosive to the surface cells of the fruit. An examination of dried rinds of lemons indicated that the injuries to the rind surface are associated with the high copper content of the necrotic tissue derived presumably from the copper sprays.

BLACKFORD (F. W.). **The establishment of a home-made cuprous oxide mixture as a Citrus fungicide in southern Queensland.**—*Qd agric. J.*, lvi, 1, pp. 4–33, 2 figs., 1 graph, 1941.

In comparative trials in southern Queensland, a short account of which has already been given elsewhere [*R.A.M.*, xx, p. 151], home-made cuprous oxide (prepared by adding to a solution of 1 lb. copper sulphate, 1 pt. molasses, or alternatively honey and 4 pts. water, one containing 5 oz. caustic soda in 3 pts. water), used at a strength of 3 gals. of the stock mixture to 40 gals. of water in the normal spraying schedule, proved as effective as Bordeaux mixture of the same copper content (i.e., 3–3–40) in controlling brown spot (*Gloeosporium* sp.), black spot (*Phoma citricarpa*), melanose (*Diaporthe citri*), and scab (*Sphaceloma fawcettii scabiosa*) [ibid., xvi, p. 451] of citrus. Black spot and melanose were also effectively controlled in one season's experiments by the 3–80 strength of cuprous oxide, and this strength was of value in one experiment against brown spot, but further experiments are considered necessary before it can be generally recommended. Cuprous oxide did not seem to injure the trees in the manner typical of Bordeaux mixture. It was found to be compatible with various sprays used against citrus pests, provided honey was substituted for molasses in the presence of soap or white oil. It was possible to fumigate trees sprayed with cuprous oxide sooner after spraying without causing injury than those sprayed with Bordeaux mixture. This is believed to be due to the fact that the former spray is washed off the leaves by rain more rapidly than the latter. In accordance with these results and taking weather into consideration spray schedules against pests

and diseases of citrus are proposed for coastal and inland districts. The purely fungicidal spray schedules for southern Queensland are applications of the cuprous oxide mixture (3–40) in late September ($\frac{1}{2}$ to $\frac{3}{4}$ petal fall) against all four diseases, a second application in late November for brown and black spots, and a third in late February against brown spot.

RUEHLE (G. D.) & KUNTZ (W. A.). **Melanose of Citrus and its commercial control.**—*Bull. Fla agric. Exp. Sta.* 349, 54 pp., 7 figs., 1940.

In spraying experiments conducted in commercial grape-fruit and orange orchards in central Florida during the years 1932 to 1937, a single application of 6–6 (hydrated lime)–100 Bordeaux mixture gave consistent control of melanose (*Diaporthe citri*) [*R.A.M.*, xx, p. 58]. A single application of a 3–3–100 mixture was sometimes equal to the stronger spray, but under conditions of severe infection decidedly inferior; two applications of the 3–3–100 spray, with an interval of three to four weeks between them, gave better results than a single treatment with the 6–6–100 formula. Pre-growth spraying proved less effective than a correctly timed application after petal fall and is not recommended except in the presence of scab [*Elsinoe fawcetti*]. Pruning alone is not considered sufficient for the control of melanose, but it is advised as a regular practice in early or mid-spring in addition to spraying. Of a number of proprietary copper sprays tested, red cuprous oxide (containing 85 per cent. metallic copper) and tribasic copper sulphate compared favourably with the 3–3–100 Bordeaux spray, but were less effective than the 6–6–100 one. Insecticides compatible with Bordeaux mixtures can also be combined with these insoluble copper materials. Wettable or bentonite sulphurs (5 to 10 lb. per 100 gals.) proved to be the most practical spreaders to use for insecticidal purposes with post-bloom copper sprays, and did not reduce their fungicidal efficiency. A form of spray injury often mistaken for true melanose and known as stellate melanose is stated to be favoured by the use of oil emulsion with or closely following copper sprays. This injury gives rise to larger and more conspicuous spots than those of true melanose, which are formed more frequently on the leaves than on fruits; the injury is rarely abundant enough to cause appreciable damage. To avoid all kinds of spray injury, no sprays should be applied to wilted trees or those beginning to flush vigorously; oil or lime-sulphur sprays should not be applied at temperatures above 90° F.; and an interval of at least three weeks should be allowed to elapse between applications of lime-sulphur and either copper or oil. Spraying schedules based on these results are given for the control of various pests and melanose and scab of oranges, grapefruit, and tangelos.

**The premature fall of Coconuts.**—*Trop. Agriculturist*, xcvi, 5, pp. 253–254, 1 graph, 1941.

In this note on the so far unexplained premature shedding of coconuts in Ceylon a graph is given which shows no relation between nut fall and rainfall. No causal organism has yet been isolated, and the condition has failed to respond significantly to every form of treatment tried.

Wallace (G. B.). **Report of Plant Pathologist.**—*Rep. Coffee Res. Exp. Sta., Lyamungu, Moshi, 1940* (*Pamph. Dep. Agric. Tanganyika* 28), pp. 15–17, 1941.

In this report [cf. *R.A.M.*, xix, p. 591] the author states that the control of coffee yellowing and leaf fall by spraying with Bordeaux mixture has been found necessary on the ash soils of Ngare-Ol-Motoni and Monduli in the Arusha District of Tanganyika. In other areas (except at the higher altitudes) *Hemileia* [*vastatrix*] is present, and the coffee on plantations owned by Europeans is being sprayed with Bordeaux mixture, so that the problem of the type of leaf fall referred to will not arise. In an experiment begun in 1940 to ascertain the minimum amount of spraying necessary to control the leaf fall, single applications in February and double applications in February and June all demonstrated that the sprayed trees retained their leaves from May to August, while the unsprayed trees were badly affected. The results given by 0·25 per cent. Bordeaux mixture were sufficiently satisfactory to justify its trial by growers. A spray solution prepared from 'perenox dispersable powder', a cuprous oxide fungicide [ibid., xix, p. 674] made by Imperial Chemical Industries, London, and used at the rate of 0·55 lb. per 32 gals., i.e., at equivalent cost and two-thirds the copper content of 0·5 per cent. Bordeaux mixture, was as effective as any other treatment tested, with the additional advantage of small bulk and ready solubility. Owing to failure of the November rains at Ngare-Olco-Motoni in 1940, flowering suffered severely. On 12th December it was found that only 3 of 64 untreated trees had flowered, 19 of 64 dusted trees, 20 to 48 (average 34) of 64 trees treated with Bordeaux mixture of different strengths, and 31 of 64 perenox-sprayed trees.

In an experiment involving neither stripping nor mulching of the guard-rows, the trees developed severe sun scorch, i.e., one side of the cherries, generally the upper and western one, showed pulp which was blackened, flat, and shrunken on to the parchment within. Trees moderately stripped were unaffected. Apparently predisposition is more conducive to the condition than exposure; in this case, the principal predisposing cause was weakness due to over-bearing. Yellowing of the foliage, leaf fall, and twig die-back were associated with the condition.

Tea scab (*Elsinoe theae*) [ibid., xix, pp. 329, 369] was confirmed on material from the Usambara mountains, where it is now very prevalent on older leaves. It was first recorded in Tanganyika in 1930.

Ling (L.) & Yang (Juhwa Y.). **Stem blight of Cotton caused by Alternaria macrospora.**—*Phytopathology*, xxxi, 7, pp. 664–671, 2 figs., 2 graphs, 1941.

A stem blight, locally known as 'dry scar', of cotton is stated to be widespread and responsible for heavy losses, especially among varieties of Asiatic cotton (*Gossypium arboreum*) in Szechwan Province, China. The pathogen, which is believed to be a strain of *Alternaria macrospora* [*R.A.M.*, xvii, p. 674; xx, p. 461], produces on the stems, twigs, and leaf petioles of mature plants dark brown, roughly circular spots, gradually turning dark grey and assuming an elliptical or oval shape,

the centres at the same time becoming deeply sunken and forming cankers. Diseased tissues usually split longitudinally or crack into fragments, and finally the infected stem or twig breaks off at the canker, causing the death of part or all of the plant. From the upper part of the petiole, the lesion may extend upwards into the midrib and veins near the leaf base.

The pathogen was isolated in pure culture on potato dextrose agar, on which it throve at a temperature range of 16° to 36° C., with an optimum at 28°. Growth took place over a wide range of hydrogen-ion concentrations with maxima at $P_H$ 4·2 and at 7·6. The fungus is characterized by brown, septate, usually simple conidiophores, 21 to 124 by 4 to 10 $\mu$, and brown, obclavate conidia, 40 to 288 by 8 to 29 $\mu$, including the beak (from 15 to 216 $\mu$ long), and provided with 3 to 13 transverse and 3 to 5 longitudinal septa. *A. tenuis* was also isolated from diseased leaves only.

In inoculation experiments American cotton (*G. hirsutum*) proved equally susceptible with *G. arboreum* to stem blight in the early stages of growth, but gradually acquired some degree of resistance. Wounding increased the incidence of artificial infection on the stems from 70 to 100 per cent. On inoculated bolls the initial minute, greyish-brown spots frequently turn purplish and coalesce, while in a very humid atmosphere conidia develop in sufficient numbers to impart a black cast to the centre of the lesion. In the field the disease is most prevalent in July, just before flowering, serious outbreaks being promoted by successive periods of rainfall and high humidity, in combination with fairly high temperatures. In 1938, for instance, a year with a wet July, 30 per cent. infection was observed in one field, whereas in 1939 the abnormally dry weather arrested the spread of the organism, the damage due to which was almost negligible. *A. macrospora* was experimentally shown to overwinter on dead, infected stalks in the field, while the possibility of seed transmission is indicated by its frequent development from surface-sterilized cotton seeds cultured on agar plates.

Blank (L. M.) & Talley (P. J.). **The carbon utilization and carbohydrase activity of Phymatotrichum omnivorum.**—*Amer. J. Bot.*, xxviii, 7, pp. 564–569, 1941.

The growth of *Phymatotrichum omnivorum* [*R.A.M.*, xx, p. 403] on different types of carbohydrates was determined by quantitative measurements. The results varied according to whether sterilization was effected by autoclaving or by treatment with alcohol, but no adequate explanation was found for these differences. Glucose, fructose, and mannose proved to be the best carbon sources. The utilization of polysaccharides was found to be correlated with the ability of the fungus to hydrolyse them and the rates at which they were hydrolysed.

Couch (J. N.). **A new Uredinella from Ceylon.**—*Mycologia*, xxxiii, 4, pp. 405–410, 12 figs., 1941.

A new species of *Uredinella* [*R.A.M.*, xvii, p. 349], on material from Ceylon sent by Mr. T. Petch is described and named *U. spinulosa* Couch & Petch. It forms minute, circular, flat patches on leaves of

*Psychotria*, always overgrowing and parasitic on a scale insect (*Aspidiotus* sp.). The fungus has irregularly coiled haustoria composed of sausage-shaped segments. Penetration apparently occurs directly through the skins of the insects. It can be distinguished from *U. coccidiophaga* [loc. cit.] by its small size, occurrence on leaves, smooth or minutely warted, globose to subglobose teleutospores, and above all by its conspicuous spines. An abundant collection of *U. coccidiophaga* growing on scale insects on *Myrica cerifera* was received by the author from Dr. G. F. Weber, Florida, where this fungus forms patches from 1·6 to 3·8 mm. wide.

CHARLES (VERA K.). **A fungous disease of Codling Moth larvae.**—*Mycologia*, xxxiii, 4, pp. 344–349, 1 fig., 1941.

A fungus was isolated in culture from larvae of the codling moth (*Carpocapsa pomonella*) from an apple orchard in Virginia, where it had killed possibly 40 per cent. of the larvae, and from one collection in Indiana and one in Delaware. In the absence of a mature ascigerous stage, the fungus is referred to *Hirsutella subulata* although it differs from the type specimen described by Petch [*R.A.M.*, xi, p. 573] and based on an English form in showing occasional bifurcate clavae and bisterigmatous phialides. The measurements of the phialides, sterigmata, and conidia of the fungus (6 to 10 $\mu$, 8 to 10 $\mu$, and 2 to 2·5 by 5 to 6 $\mu$, respectively) exceeded those given by Petch, but attention is drawn to the fact that the measurements of the conidia given by him for two North American specimens from the Farlow Herbarium also exceeded the measurements given in his diagnosis of the species.

KOBAYASI (Y.). **The genus Cordyceps and its allies.**—*Sci. Rep. Tokyo Bunrika Daig.*, Sect. B, v, 84, pp. 53–260, 70 figs., 1941.

Of the 200-odd species previously included in the genus, the author recognizes 124 as good species of *Cordyceps*, and regards the remainder as synonyms or as to be suppressed or transferred to other genera. He further proposes 13 species and one variety as new. Of these 137 species, about half are known only from their type collections.

On ascus and ascospore characters, he recognizes three subgenera, *Ophiocordyceps* (Petch), *Eucordyceps*, and *Neocordyceps*; and again divides the first two into sections on the position of the perithecia relative to the stroma, i.e., whether superficial or immersed, and whether perpendicular or oblique to the surface. All the species accepted are fitted into one of the dichotomous keys given under each section; and all those of which material has been examined are fully described in Latin.

Two of the species are found on sclerotia of *Claviceps*, five on fruit bodies of *Elaphomyces*, five on spiders, and 125 on the adult bodies, larvae, nymphs, or pupae of various insects. The full details of host and geographical distribution are given under each species, and also set out in a long table. Wherever known the conidial states are named, different species being placed in *Isaria*, *Hirsutella*, *Hymenostilbe*, *Stilbella*, *Cephalosporium*, and *Sporotrichum*; a further two species produce their conidia in pycnidial cavities formed on the stromata.

The paper ends with the description of 36 Deuteromycetes found on insects in Japan, mostly by the author. Unlike the species of *Cordyceps*,

some of them occur on insects of widely differing relationships. Six new species of *Isaria* are described, and one each of *Hirsutella, Hymenostilbe, Polycephalomyces* (gen. nov.), *Stilbella*, and *Sporotrichum*.

REIS (J.). **Queratomicose aspergílica epizoótica em Pintos.** [Epizootic keratomycosis caused by *Aspergillus* among Chicks.]—*Arq. Inst. biol., S. Paulo*, xi, 48, pp. 437–450, 12 pl., 1940. [English summary.]

Nearly 100 out of 1,000 chicks at a poultry farm near São Paulo, Brazil, were found in October, 1939, to be suffering from a disease of the cornea of the eyes, attributable to infection by *Aspergillus fumigatus* [*R.A.M.*, xviii, p. 679]. The fungus was isolated in pure culture on Czapek's agar and inoculated, in the form of spore suspensions, into the scarified cornea with positive results, which were likewise obtained with a strain of *A. flavus* from pulmonary aspergillosis in a parrot. The clean sawdust used as litter was found to be the source of infection.

CONANT (N. F.). **A statistical analysis of spore size in the genus Microsporum.**—*J. invest. Derm.*, iv, 4, pp. 265–278, 2 graphs, 1941.

Continuing his studies on the genus *Microsporon* at the Duke Hospital, Durham, North Carolina [*R.A.M.*, xvii, p. 174], the writer made statistical analyses of eight species, viz., *M. fulvum, M. gypseum, M. obesum, M. simiae, M. equinum, M. pseudolanosum* [previously spelt *pseudosolanosum* in error: loc. cit.], *M. aurantiacum*, and *M. canis*, of which only the two first- and the last-named, with mean spore lengths of 39·56, 44·96, and 73·71 $\mu$, respectively, are regarded as actually entitled to differential rank, the same being accorded to *M. audouini*. The curves of *M. equinum, M. pseudolanosum*, and *M. aurantiacum* (61·79, 64·47, and 70·07 $\mu$, respectively) overlapped not only each other, but also the curve of *M. canis*, while overlapping further occurs between *M. obesum*, and *M. simiae* (55 and 58·29 $\mu$, respectively). In connexion with the taxonomy of the species variously referred to *M. fulvum* and *M. gypseum*, the latter name (Bodin, 1907) takes precedence of the former (Guiart & Grigorakis, 1928), so that the genus at present comprises three authentic species, namely, *M. audouini, M. gypseum*, and *M. canis*.

REISS (F.). **Dermatophytosis of the hands and feet.**—*Urol. cutan. Rev.*, xlv, 5, pp. 328–337, 1941.

Following a brief review of the history of interdigital dermatophytosis in China, the writer analyses the results of cultural studies in 14 out of 71 microscopically positive cases treated in 1939–40 as follows: *Trichophyton gypseum* and *Epidermophyton* [*T.*] *rubrum* one each, *E. inguinale* [*E. floccosum*] four, and *E.* [*T.*] *interdigitale* eight, the total number of cases of fungal infection of the hands and feet investigated during the period under review being 547. Symptoms and other features of the diseases are fully discussed.

STUDT (BETTY). **Morphological and physiological studies of a strain of Candida albicans associated with vaginitis.**—*Amer. J. Bot.*, xxviii, 7, pp. 509–516, 1 fig., 1941.

A yeast-like fungus, isolated in 1938 from the vaginal discharge of

a pregnant woman, was identified as *Candida albicans* [cf. *R.A.M.*, xvi, pp. 99, 177]. It was causing a seropurulent discharge associated with the development of white patches on the walls of the vagina. The author accepts the name *Candida* in preference to *Monilia* for the yeast-like fungus parasitic on animals, and considers that the former will no doubt be validated by the next International [Botanical] Congress.

On Sabouraud's glucose agar the fungus produced a smooth, glossy, cream-coloured growth of pasty consistency; about 48 hours after inoculation a much branched mycelium was formed around and beneath the pasty mass, growing down into the agar. Yeast-like oval spores, 3·5 to 7 by 3 to 4·5 $\mu$, reproduced by unipolar (rarely bipolar) budding, compose the bulk of the central mass. On the mycelium spores arise at the septa and bud off chains of spores which continue to bud, producing branched compound verticils, and eventually forming compact masses which completely obscure the mycelium. Apart from these thin-walled blastospores round, thick-walled chlamydospores (gemmae of Shrewsbury) [ibid., xiii, p. 635], 6 to 10 $\mu$ in diameter, are formed. These stain deeply with iodine and with orseillin BB and may thus be distinguished from the lighter-staining blastospores. They are borne singly or in chains of two, terminally or on short lateral branches. The strain is considered quite stable, as its biochemical reactions remained constant over a period of two years. In glucose, levulose, and maltose both gas and acid were formed; in sucrose, dextrin, and inulin, acid accumulated, while neither acid nor gas was formed in lactose. Under certain nutritive conditions both acid and gas were formed in galactose, but with a peptone base, only acid was produced. It was found that the nitrogen, rather than the carbon source is the limiting factor in the growth of the fungus in the laboratory. When organic nitrogen in the form of bacto peptone was supplied to the cultural media, no carbohydrate was necessary for normal and abundant growth of the colonies.

Baker (E. E.) & Mrak (E. M.). **Spherule formation in culture by Coccidioides immitis Rixford and Gilchrist, 1896.**—*Amer. J. trop. Med.*, xxi, 4, pp. 589–595, 1 pl., 1941.

In the writers' studies at Stanford University School of Medicine, San Francisco, and the University of California, Berkeley, spherical or oval, terminal or intercalary spherules, 10 to 20 $\mu$ in diameter, were formed by certain strains of *Coccidioides immitis* [*R.A.M.*, xvii, p. 820] of human and animal origin on Sabouraud's glucose and potato dextrose agars and a synthetic medium containing 0·05 per cent. copper sulphate, the withdrawal of which appeared adversely to affect the production of the bodies in question, whereas the influence of other nutrients was indeterminate. The spherules developed both at room temperature and at 37° C., usually after an incubation period of six to eight weeks, and only on solid or semi-solid substrata. The capsulate walls of the spherules do not react to any of the common stains. Irregular or spherical endospores develop through the formation of successive cleavage planes in the spherules, the only difference between which and those formed in the host tissues is the larger size of the latter (20 to 40 or up to 80 $\mu$).

Parsons (R. J.). **Transformation of the mycelial form of Histoplasma capsulatum, Darling, to the yeastlike form in mice.**—*Arch. Path. Lab. Med.*, xxix, 5, p. 731, 1940.

Cultures on a tartaric acid-agar medium at room temperature of the yeast-like bodies isolated from a nasal septal ulcer in a female patient at Ann Arbor, Michigan, developed into the mycelium of *Histoplasma capsulatum* [*R.A.M.*, xx, p. 405]. The yeast-like form of the fungus being solely responsible for progressive infection in man and animals, the author wished to convert the mycelial into the yeast-like phase, and this object was successfully accomplished by the intravenous injection of the mycelial form into young mice, autopsies on which revealed extensive parasitization of the macrophage system by the yeast-like elements of *H. capsulatum.*

Wright (R. B.) & Hachtel (F. W.). **Histoplasmosis of Darling; report of a case.**—*Ann. intern. Med.*, N.S., xv, 2, pp. 309–319, 4 figs., 1941.

The mycelial form of *Histoplasma capsulatum* obtained from blood cultures of the authors' patient, a 59-year-old diabetic barman, at the Maryland School of Medicine, Baltimore, was injected subcutaneously into a Rhesus monkey, the resultant abscess giving rise on blood agar at 37° C. to the yeast-like phase of the fungus [see preceding abstract]. A second monkey into which the latter form of the pathogen was injected became ill but subsequently recovered, and the organism could not be demonstrated at autopsy several months later, though blood cultures made while the disease was in progress yielded *H. capsulatum.*

Reeves (D. L.), Butt (E. M.), & Hammack (R. W.). **Torula infection of the lungs and central nervous system: report of six cases with three autopsies.**—*Arch. intern. Med.*, lxviii, 1, pp. 57–79, 8 figs., 1941.

This is a detailed account of the clinical and histological features of six cases of torulosis of the pulmonary and central nervous systems, encountered in the authors' Californian hospital practice, five in men (all fatal) and one in a 15-year-old girl still living 2½ years after the onset of the disease. The causal organism, *Torula histolytica* [*Debaryomyces neoformans*: *R.A.M.*, xx, p. 532], was isolated in pure culture in each instance, inoculated into monkeys, and the diagnoses confirmed by J. F. Kessel, of the mycological department of the Los Angeles County Hospital.

Almeida (F.) & Simões Barbosa (F. A.). **Contribuição para o estudo de 'Cephalosporium recifei'.** [A contribution to the study of *Cephalosporium recifei*.]—*Arq. Inst. biol., S. Paulo*, xi, 1, pp. 1–4, 2 pl., 1940. [English summary.]

Of the various media used in the authors' cultural study of *Cephalosporium recifei*, the causal organism of a mycetoma of the foot in a 34-year-old male Brazilian at Pernambuco, originally isolated in 1934 by Arêa Leão and Lobo [*R.A.M.*, xiv, p. 170], Czapek's agar proved to be the best adapted to the production of the characteristic colonies of the fungus, with a lemon-yellow central zone surrounding a raised,

cream-coloured button, and a downy, white periphery, with a bright pink transitional zone. The simple, hyaline, straight conidiophores measure 20 to 30 $\mu$ in length, and the smooth, hyaline, crescent-shaped conidia 5 to 6 by 0·5 to 1 $\mu$.

Ramos (M. M.). **Dry-sheath-rot of Abacá caused by Marasmius and suggestions for its control.**—*Philipp. J. Agric.*, xii, 1, pp. 31–41, 3 pl., 1941.

Since 1936, different varieties of abacá [*Musa textilis*] in the Cavite, Mindoro, Bicol, and Davao areas of the Philippine Islands have been sporadically attacked, generally after a long period of drought, by a species of *Marasmius* referred to *M. semiustus* [*M. stenophyllus*: *R.A.M.*, xv, p. 778; xx, p. 7]. The fungus first exists as a soil saprophyte, but later attacks the corms, and penetrates the other living tissues of the plant. Under conditions of high temperature and moisture, it becomes an aggressive parasite, destroying numerous roots and attacking the developing buds and suckers. The affected part of the stem develops a dark brown, water-soaked appearance. The outer leaves dry up more rapidly than they are replaced. The amount of foliage is much reduced, and the affected plant is pale and stunted, and usually dies prematurely.

Inoculations were made at different times of the year on two- to five-months-old abacá seedlings of five different varieties by the insertion of portions of cultures between the outermost leaf sheaths, and by placing inoculum on the base of the plant just above soil-level. Most of the inoculated plants showed infection after five days. Of 23 inoculated Maguindanao plants, 11 died after three months, the corresponding figure for Baluñganon being 3 out of 6 and for Tañgoñgon, 3 out of 23.

Field observations showed that even if infected plants survived to the fruiting stage, they were economically valueless. Fungal growth and spread were found to be favoured by improper cultural practices and prolonged warm, moist weather. Infection generally occurs on humid days in poorly aerated, neglected plantations.

The fungus is characterized by a white, later dark pileus 5 to 15 mm. in diameter, convex when young, flat or almost concave at maturity, and white, hyaline, ovate spores measuring 3·6 to 10·8 by 3·6 to 9 (average almost 7·2 by 5·4) $\mu$.

Control measures suggested include sanitation, roguing, proper distancing, and the planting of rootstocks from disease-free fields.

Neergaard (P.). **Nye eller upaaagtede Prydplantssygdomme i Danmark. 9–12.** [New or unobserved diseases of ornamental plants in Denmark. 9–12.]—Reprinted from *Gartnertidende, 1940*, 4 pp., 5 figs., 1940.

The writer describes the symptoms and recommends measures for the control of some new or hitherto unobserved diseases of ornamentals in Denmark [cf. *R.A.M.*, xviii, p. 596]. In addition to those listed in the report of the Ohlsen seed-testing laboratory, Copenhagen, for 1939–40 [ibid., xx, p. 526], mention may be made of Hollandia Wedgwood iris mosaic [ibid., xviii, p. 572] and purple spot of rose (*Sphaceloma rosarum*) [ibid., xviii, p. 112].

DEACON (G. E.). **A fungus disease of some species of Rosa.**—*Rose Annu.*, *1941*, pp. 113–115, 2 pl., 1941.

*Didymella sepincoliformis*, considered to be the agent of a sudden wilting and death of young lateral and terminal shoots of various species of rose in England, including *Rosa willmottiae*, *R. ecae*, *R. canina*, and *R. arvensis*, is characterized by flattened, globular perithecia, with thick, black, pseudoparenchymatous walls and a small, circular ostiole, giving rise to a fascicle of cylindrical or subfusoid, aparaphysate asci, containing eight fusoid or ovoid, uniseptate, uni- to triguttulate, hyaline ascospores, 17 to 19 by 6 to 8 $\mu$. Mature perithecia are produced in greatest abundance in March and April, but the organs are present in various stages of development in every month of the year. Spore discharge begins at the end of March and wilting takes place at the end of May, shortly after which brown pycnidia, containing globular to oblong, continuous, hyaline spores, 7 to 8 by 7 $\mu$, appear on the bark of the diseased shoots. The perithecia usually begin to develop in September on twigs contracting infection the previous May, and by the latter part of October they are visible in large numbers as black dots in the bark, surrounded by a white halo of raised cuticle. The onset of colder weather tends to postpone further growth until February. The disease is very persistent, and in all the bushes under observation has recurred regularly for the last five years. Attempts to isolate the pathogen in pure culture and artificial inoculation experiments were unsuccessful.

HOPKINS (J. C. F.). **Diseases of fruit, flowers, and vegetables in Southern Rhodesia. 3. Common diseases of Snapdragon.**—*Rhod. agric. J.*, xxxviii, 8, pp. 441–447, 2 pl., 1941.

In these notes on the symptoms, causes, and control of *Antirrhinum* [*majus*] diseases in Southern Rhodesia, the author states that damping-off is caused locally by *Pythium de Baryanum*, *Rhizoctonia* [*Corticium*] *solani*, and *Phytophthora parasitica*. The disease is very prevalent during the warm, rainy months of December, January, and February, and is especially troublesome on seedlings raised under thatch to protect them from rain. For control purposes, seedlings should not be raised under low shade, and the surface of the soil should be dusted with Bordeaux powder after the seed has been sown and covered up.

The most frequent cause of foot rot [*R.A.M.*, xiv, p. 678] is *P. parasitica*, which is almost always followed by *C. solani*. Infection generally occurs at transplanting time, if the plants are allowed to wilt before becoming fully established; young plants may be killed at this stage. The disease may also occur on plants over a year old. Infection may be prevented by avoiding excessive soil humidity, shading the young plant at transplanting with a mulberry leaf, and sprinkling a teaspoonful of Bordeaux powder round each plant at setting out. The disease may also be prevented by three applications to the bed at weekly intervals of Cheshunt compound.

Rust (*Puccinia antirrhini*) [cf. ibid., xx, p. 150] has only recently appeared in Southern Rhodesia, but it seems already to have become widely prevalent. It was first reported from Bulawayo district in October, 1940, where it was then well established. More recently, it

has been reported on several occasions from Mashonaland. It is likely to prove more serious in the cool winter months than in summer. All young diseased plantings examined in June and July, 1941, showed a very high degree of infection, whereas older plantings, which made most of their growth during summer, were less seriously affected, only about 50 per cent. of the plants being badly attacked. The main factor in control is the removal and destruction by burning of all infected plants before new sowings are made. Antirrhinums should not be grown successively in the same ground. Until satisfactory resistant strains are available, fungicidal treatment should be adopted, using Bordeaux mixture (8 lb. ready-mixed powder per 40 gals. water, plus 1 oz. lethalate or 5 oz. casein spreader), bouisol (1 pint per 10 gals. water plus 4 oz. household soap), dusting sulphur, or colloidal sulphur (8 fluid oz. per 10 gals. water plus 4 oz. soap). Treatment should begin when the plants are about 2 in. high, and should be repeated twice before the flowers open.

The only troublesome form of leaf spot found locally is that due to *Phyllosticta antirrhini* [ibid., vii, p. 723], which is most prevalent in the rainy season, but is favoured by overhead watering during dry weather.

Blodgett (C. O.) & Mehlquist (G. A. L.). **Snapdragon rust-resistance trials.**—*Hilgardia*, xiii, 10, pp. 569–581, 1941.

A tabulated account is given of the data secured in trials conducted in California in 1937–8 in connexion with an attempt to discover species, varieties, or strains of *Antirrhinum* immune from, or at least highly resistant to, the new, as well as to the original, physiologic races of *Puccinia antirrhini* [*R.A.M.*, xvi, p. 387]. Seed for the experiments was obtained from Belgium, Rumania, Germany, Sweden, Italy, France, England, Turkey, and the Lompoc district of California. None of the commercial varieties tested in more than one locality proved to be immune from the rust, though several, including 3R and 4R from Michigan, were highly resistant, as were also *A. asarina*, *A. chrysothales*, *A. glandulosum*, *A. maurandioides*, *A. orontium*, *A. ibanjezii*, and *A. siculum* [cf. ibid., xv, p. 227], though the distance of the taxonomic relationship of these species to *A. majus* casts some doubt on their utility in a plant-breeding programme.

The low humidities and high temperatures prevailing in the Sacramento Valley in 1937 were apparently not conducive to the development of *P. antirrhini*, which did not assume an aggressive form until the onset of cooler conditions after mid-September, too late to interfere significantly with seed production. Wind was observed to aid the dissemination of the rust to a very appreciable extent, the incidence of infection being uniformly heavier on the leeward than on the windward side. The second physiologic race of *P. antirrhini* appears for the moment to be confined to the coastal regions of Salinas, Guadelupe, and Lompoc, where it did not develop until three years after the introduction of resistant varieties. The outbreak of rust at Lompoc in 1936 was so severe that seed crops were seriously damaged, whereas at Guadelupe in the same year infection was very light. In the succeeding year the incidence of rust infection was completely reversed.

This behaviour is inexplicable, but factors other than hereditary ones evidently play a role in determining relative severity of rust infection.

PAPE (H.). **Triebsterben bei Phlox. Ein Pilz der Erreger.** [Death of Phlox shoots. A fungus the agent.]—*Blumen- u. PflBau ver. Gartenwelt*, xliv, 32, pp. 282–283, 1940. [German. Abs. in *Biol. Abstr.*, xv, 7, p. 1431, 1941.]

Of recent years perennial phlox (*Phlox decussata*) in Central Europe has suffered from a disease characterized by more or less extensive cankers on various levels of the stem, eventuating in wilting and death of the shoots. A description is given of the causal organism, *Phoma phlogis*, from which some phlox varieties were apparently immune in the midst of others that had contracted infection. A similar disease of the same host in France is attributed to *Diplodina phlogis*.

DIMOCK (A. W.). **Rhizoctonia foot rot of Stocks can be controlled.**—*Flor. Rev.*, lxxxvii, 2244, pp. 13–14, 3 figs., 1940. [Abs. in *Exp. Sta. Rec.*, lxxxv, 2, p. 216, 1941.]

Stocks [*Matthiola incana*] at Cornell University, New York, were experimentally shown to be susceptible to the destructive disease caused by *Rhizoctonia* [*Corticium* (?) *solani*: *R.A.M.*, xv, p. 24] until they are two months old, but may remain so much longer, while the causal organism is able to spread through the soil at the rate of 10 in. per month. Sterilization of the soil by means of steam or chloropicrin resulted in perfect stands.

REINMUTH (E.). **Die Blattschüttekrankheit der Luzerne.** [Leaf fall disease of Lucerne.]—*Angew. Bot.*, xxiii, 2, pp. 62–68, 3 figs., 1941.

Heavy damage is stated to have been caused of recent years to lucerne crops in the Rostock district of Germany by the brown spot or leaf fall disease (*Macrosporium* [*Stemphylium*] *sarciniforme*) [*R.A.M.*, vii, p. 380]. The ascigerous stage of the pathogen was referred by Gentner (*Prakt. Bl. Pflanzenb.*, xvi, p. 97, 1918) to *Pleospora herbarum*, but since the latter fungus has also been associated with other conidial forms, e.g., *M. commune*, *M. sarcinula*, and *M. parasiticum* [all synonyms of *S. botryosum*: *R.A.M.*, xviii, p. 141], producing different symptoms from the organism under observation, the systematic position of the agent of leaf fall remains in some doubt [cf. ibid., xx, p. 307]. H. Richter, who first referred the lupin disease to *S. sarciniforme* [ibid., xviii, p. 116], found in subsequent experiments (*Ber. Anst.* (*Reichsanst.*) *Berl.*, 1940) that strains of the organism from clover and lucerne failed to infect lupin and vice versa, while differences in conidial dimensions also indicated that a new species of *Macrosporium* is concerned in the lupin disorder.

Infected lucerne leaves, and later the stems, bear numerous brown to black dots or circular spots, often scarcely reaching 1 mm. in diameter, the larger ones turning paler towards the centre. The disease spreads from the basal to the upper leaves, all the foliage being shed in severe cases, leaving the plant entirely bare. Two- and three-year-old stands sustain the heaviest damage from leaf fall, though older ones may also be affected, while the pathogen further attacks red, white, and

crimson clovers (*Trifolium*) [*pratense*, *T. repens*, and *T. incarnatum*] and various wild *T.* spp. The olive-brown, muriform-septate conidia are stated to be verrucose [a characteristic feature of the conidial stage of *P. herbarum* distinguishing it from the smooth-spored *S. sarciniforme*].

The leaf fall of lucerne is most prevalent in seasons when wet late summer weather follows a dry period, as in 1937, when the fine, warm spell from the end of May to mid-July was succeeded by almost daily heavy rains from 20th July to 1st August. An unduly acid soil reaction ($P_H$ 5·5 to 5·7 in the cases investigated by the writer) also contributes to severe infection. Klinkowski [*R.A.M.*, xvii, p. 325] recommends the incorporation of lime into the soil as a corrective for this condition.

Reinmuth (E.). **Gesundheitsschädigungen durch Verfütterung von pilzkrankem Klee.** [Health disturbances caused by the use of fungus-infected Clover for fodder.]—*Dtsch. landw. Pr.*, lxviii, 12, pp. 103–104, 5 figs., 1941.

Severe and often fatal illnesses, characterized by a sudden onset and virulent course, are reported to occur in horses, cattle, and sheep fed on clover, chiefly alsike [*Trifolium hybridum*], infected by various leaf diseases, notably *Polythrincium* [*Dothidella*] *trifolii* [*R.A.M.*, iv, p. 96; xix, pp. 365, 731], in East Prussia and certain other districts of Germany.

Cherewick (W. J.). **Rhizoctonia root rot of Sweet Clover.**—*Phytopathology*, xxxi, 7, pp. 673–674, 1941.

A species of *Rhizoctonia*, probably a strain of *R.* [*Corticium*] *solani*, has been found to cause a typical damping-off of sweet clover (*Melilotus*) seedlings and a dark brown, dry rot of the roots, stunting, and wilting of two- to four-month-old plants in widely separated districts of Manitoba, Canada, and in Minnesota, this being apparently the first record of the fungus as a pathogen of the host in question. The organism, which is a very rapid grower, covering a Petri dish at 25° to 30° C. in less than 48 hours, and forming brown, irregular sclerotia at the age of two to three weeks at room temperature, was pathogenic in inoculation experiments to numerous varieties of *M. alba*, *M. officinalis*, and *M. suaveolens*, as well as to clover (*Trifolium pratense* and *T. hybridum*), lucerne, peas, soy-bean, and *Vicia angustifolia*. In greenhouse trials during the past three years, 90 to 100 per cent. of the inoculated sweet clover seedlings contracted damping-off, and 50 to 85 per cent. of the older plants were killed, while all the sweet clover plants in artificially infected rows in the field were destroyed in the spring of 1940. The forage yield of the Common Yellow and White Blossom varieties, inoculated after six weeks of growth, was reduced by 47·7 and 32·5 per cent., respectively. Species of *Fusarium* tend to supersede *C. solani* in the later stages of the root rot, for which the latter, however, is regarded as primarily responsible.

Sprague (R.). **Stagonospora arenaria on grasses.**—*Mycologia*, xxxiii, 4, pp. 371–379, 2 figs., 1941.

The synonymy and an emended description are given of *Stagonospora arenaria*, causing a purple leaf blotch of a number of grasses (*Elymus*

*arenarius*, *E. glaucus*, *E. canadensis*, *E. mollis*, *Dactylis glomerata*, *Arrhenatherum elatius* [*A. avenaceum*], and *Phalaris arundinacea*) in northern Europe, Alaska, Oregon, Washington, Wisconsin, Ohio, and Pennsylvania. The characteristic purple or dark brown lesions, which have light straw or tawny borders on some hosts and yellow to fawn on others, generally fade, as the attacked leaves die, to a straw or buff colour. The pycnidia of the fungus were scattered, not prominent, golden-brown to sepia, subglobose, erumpent, ostiolate, thin-walled, and 50 to 160 (240) $\mu$ in diameter. The pycnophores were short, botuliform or subcylindrical; the spores cylindrical or subfusiform, their bases often blunt, tapering to a pointed to blunt apex, hyaline, with small oil drops, with 3 (1 to 4) septa, 26 to 61 by 2·6 to 5 $\mu$, often 30 to 40 by 3·5 to 4·3 $\mu$ (smaller on *Arrhenatherum*). The original description, based by Saccardo on a specimen from Sweden, is emended to include the North American material with the smaller pycnidia.

*S. arenaria* is morphologically very similar to the pycnidial stage of *Leptosphaeria avenaria* (*S. avenae*) [*R.A.M.*, ii, p. 159], but the latter produces no purple blotching on oats and develops both the pycnospores and ascospores in culture whereas *S. arenaria* remains sterile. For the present it is therefore regarded as distinct.

FISCHER (G. W.). **'Bends', a new disease of grasses and cereals.**—*Phytopathology*, xxxi, 7, pp. 674–676, 1 fig., 1941.

A new disease of grasses and cereals known as 'bends', first noticed at Pullman, Washington, in 1937, and characterized by a more or less sharp bend in the culm at or above the uppermost node, accompanied by discoloration and brittleness of the affected region, which in extreme cases hangs down parallel with the portion below it, has become increasingly prevalent in the Pacific Northwest. By the end of 1940 the recorded hosts included 8 species of *Agropyron*, 11 of *Bromus*, *Andropogon hallii*, *Dactylis glomerata*, *Secale cereale* × *S. montanum*, Albit wheat, and representatives of ten other genera. From the diseased portions of 16 species of grasses 238 cultures of such fungi as *Alternaria*, *Chaetomium*, *Epicoccum*, *Helminthosporium*, *Hormodendrum*, *Macrosporium*, and *Sclerophoma* were obtained, but so far their part, if any, in the causation of the trouble is unknown.

WARNE (L. G. G.). **Observations on the effect of potash supply on the tension of the tracheal contents in fruit trees and bushes.**—*J. Pomol.*, xix, 1–2, pp. 82–86, 1941.

The author presents experimental data referring to the relative tension in the tracheae of apples, gooseberries, and raspberries growing in the field under conditions of potash deficiency and normal manuring. The method used was to fix a plasticine cup round the shoot to be tested, fill the cup with a 1 per cent. solution of acid fuchsin, and stab the stem beneath the surface of the dye. The mean values for penetration of the dye upwards for the plants receiving complete fertilizer were, respectively, 9·07±0·81, 5·98±0·24, and 8·86±0·4 cm., the corresponding figures for the no-potash plants being 13·08±0·73, 7·95±0·41, and 12·04±0·5 cm. These results are significant and it is concluded that, under the conditions prevailing when the observations

were made, there was a greater tension in the tracheae of the no-potash plants than in those of the plants that received a complete fertilizer. Under conditions of good water supply and minimal transpiration the existence of tension probably indicates a slight internal water deficit, with no serious consequences to the plant, but the increased tension due to potash deficiency does indicate a more marked condition of internal drought and a nearer approach to the point at which internal drought becomes a critical factor. Hence in potash-deficient trees this critical point is likely to be reached much earlier than in those receiving a complete fertilizer. This is probably due, among other causes, to (1) increased stomatal frequency caused by potash deficiency, and (2) the poor root development found in potash-deficient plants.

TYDEMAN (H. M.). **The inheritance of susceptibility to sulphur damage in families of seedling Apples.**—*J. Pomol.*, xix, 1–2, pp. 137–145, 1941.

Observations at East Malling on the reactions of seedlings from crosses between apple varieties to injury from spring applications of lime-sulphur against scab [*Venturia inaequalis*: *R.A.M.*, xix, p. 606] showed that when Stirling Castle, which is highly susceptible to sulphur injury, was used as a parent the proportion of sulphur-shy seedlings (i.e., those susceptible to injury) was high, varying according to the other variety used as parent. Families of crosses not involving Stirling Castle in which White Transparent, Cox's Orange Pippin, and Rote Sommer Apfel were used as one parent averaged 7 to 54 per cent. sulphur-shy seedlings, but in the individual families great variation was present. With most of the other varieties used as parents, only a small proportion of seedlings were sulphur-shy. It is concluded that sulphur-shyness is inherited and is controlled by a number of genes.

HOLBECHE (J. A.) & FERGUSON (S. W.). **Apply borax with care.**—*Agric. Gaz. N.S.W.*, lii, 8, pp. 429, 434, 1 fig., 1941.

Injury having been caused to apple trees in New South Wales as a result of faulty applications and excessive dosages of borax against internal cork, a test was made in which the soil was removed from some of the roots of apple trees of different varieties about 2 ft. (in one case, about 14 in.) from the butt. The exposed roots ranged from $\frac{1}{4}$ to 3 in. in diameter. Borax ($\frac{1}{3}$ to 2 oz.) was then placed on the upper surface of the roots, and the soil replaced. In no case did the quantity of borax applied to any tree exceed the officially prescribed dosage. About one year later, all the treated roots showed severe damage (most being dead for 6 to 12 in. on each side of the point where the borax was applied), and in one case (2 oz. borax applied 14 in. from butt) the trunk itself was injured, the affected part measuring 12 in. long by 2 in. wide.

Recommendations for the application of borax against apple and pear cork are as follows [cf. *R.A.M.*, xviii, p. 155]. If used as a soil dressing, borax should be applied in July or August at the rate of $\frac{1}{4}$ lb. per tree to small bearing trees, $\frac{1}{2}$ lb. to medium-sized trees, and 1 lb. to large trees. It should be spread evenly in a ring about 2 ft.

wide commencing 2 or 3 ft. from the butt, and should be worked into the soil. Young non-bearing trees should not be treated with borax.

REYNEKE (J.) & DU TOIT (M. S.). **Shoot growth and fruit relationships of the Kelsey Plum.**—*Bull. Dep. Agric. S. Afr.* 219, 54 pp., 4 figs., 14 graphs, 1940.

In part II of this bulletin studies are reported on the rate of ripening of the Kelsey plum in relation to certain physiological disorders in South Africa. It was found that an increased susceptibility of the fruit to Kelsey spot (or heat spot) [*R.A.M.*, xvi, p. 473] in the orchard and to internal browning (a type of internal breakdown [ibid., xix, p. 286] characterized by a browning of the tissue round the stone) and its extreme stage vacuolation (in which the external surface, become dry and totally brown, collapses inwards, particularly round the stem end of the fruit) in storage was associated with an increased rate of ripening of the fruit. This, in turn, resulted from an increased rate of intake of non-reducing sugars by the fruit following a reduction in the shoot growth. Quick-ripening fruits or those with short harvesting periods, usually from crops grown under rigorous conditions, developed vacuolation more readily than slower-ripening fruits or those with long harvesting periods, usually grown under more fertile conditions, which tended to develop soft or crinkly skin (a condition leading to fine cracks in the skin with oozing of the juice) during storage. Immature fruits and those from earlier pickings were more susceptible to internal browning than ripe fruit or those from later pickings, these in turn being more likely to develop soft skin. Within the same area, trees grown on shallow or very light-textured soils tended to produce fruit very susceptible to Kelsey spot and storage disorders, and characterized by a decreased soluble solids/acid ratio and an increased acid content of the juice. Fruits with a soluble solids/acid ratio less than 15 should not be stored, the ratio to aim at being at least 20. It is suggested that the association between the rate of ripening and Kelsey spot is due to the fact that both factors are largely determined by the rate of material inflow into the fruit during the third stage of development. The relationship between rate of ripening and internal browning on the other hand is explained on the basis of a differential ripening of tissues.

HILDEBRAND (A. A.). **The reaction of Fragaria virginiana to the virus of yellow-edge.**—*Canad. J. Res.*, Sect. C, xix, 7, pp. 225–233, 1 pl., 3 diags., 1941.

In experiments in Canada during 1937, 1938, and 1939, designed to demonstrate the suitability of the common wild strawberry, *Fragaria virginiana*, for use as an indicator plant in yellow-edge virus studies [*R.A.M.*, xix, p. 716], clones of this species were found to vary widely in their resistance and susceptibility to the virus. When runner-grafted to domestic plants of the strawberry varieties Premier and Glen Mary, both symptomless carriers of the virus, some clones of *F. virginiana*, of a noticeably delicate type of growth, were highly susceptible to deterioration and exhibited all symptoms, while among those with a robust growth some showed virtually complete resistance, whereas others, although readily susceptible, were capable of at least partial

recovery. Furthermore, *F. virginiana* is generally much more resistant to root rot than any of the cultivated varieties tested and its use in breeding work is recommended.

WARDLAW (C. W.). **The Banana in Central America.**—*Trop. Agriculture, Trin.*, xviii, 8, pp. 157–163, 10 figs., 1941.

This is a series of three papers reprinted from *Nature, Lond.*, the first dealing with the cultivation of the banana [ibid., 15th March, 1941], the second with the control of leaf spot (*Cercospora musae*) [*R.A.M.*, xx, p. 265], and the third with Panama disease (*Fusarium oxysporum* var. *cubense*) [ibid., xx, p. 266].

WOLFE (H. S.) & LYNCH (S. J.). **Papaya culture in Florida.**—*Bull. Fla agric. Exp. Sta.* 350, 35 pp., 1940.

The only two important fungal diseases of papaw in Florida are leaf spot due to *Pucciniopsis* [*Asperisporium*] *caricae* [*R.A.M.*, iv, p. 682; xx, p. 26] and fruit rot caused by a species of *Colletotrichum* identical with or closely allied to *C. gloeosporioides* [loc. cit.]. According to H. E. Stevens [loc. cit.], *A. caricae* responds to three or four applications of Bordeaux mixture (3–3–50) made to the under surface of the mature leaves at fortnightly intervals, after removal of the infected foliage. If conditions favour vigorous growth, the leaves are moderately resistant, and spraying may be unnecessary. Powdery mildew (*Oidium* [*caricae*: loc. cit.]) may also cause considerable injury in a few weeks, but yields to two or three applications of sulphur at ten-day intervals.

GAR (K. A.). **A method for testing Bordeaux mixture.**—*Sadovod.*, *1940*, 4, p. 38, 1940. [Russian. Abs. in *Chem. Abstr.*, xxxv, 14, p. 4907, 1941.]

An ordinary filter paper is immersed in a 5 or 10 per cent. potassium ferrocyanide solution, dried, and cut into small strips, on which an excess of copper sulphate in the Bordeaux mixture may be detected by a pinkish-brown colour. Up to 0·05 per cent. of free copper sulphate produced a perceptible coloration in the writer's tests, and approximately the same concentration was found to cause scorching of foliage in the U.S.S.R.

STRINGFELLOW (W. A.). **Developments in mold and mildew prevention.**—*Amer. Dyest. Rep.*, xxix, 11, pp. P266–P269, 3 diags., 1940.

In tests at the laboratories of the Ciba Company, New York, on samples of cloth inoculated after 6 to 24 hours' exposure to drastic showering with cultures of *Chaetomium globosum* [cf. *R.A.M.*, xviii, p. 696] and incubated at 85° F. for two to three weeks, the best control of the fungus was given by dowicide G (sodium chlorophenate) [ibid., xx, p. 388]. Detailed instructions for the application of the preparation to cloth in open width are given. Field trials in southern localities are in progress to substantiate the promising outcome of these experiments.

HAROLD (B. A.). **Factors affecting mildew behavior on textiles.**—*Amer. Dyest. Rep.*, xxx, 11, pp. 274–276, 292, 1 fig., 1941.

The writer's own observations on the factors affecting mildew

development on textiles in the United States are reviewed in connexion with the studies along similar lines of Burgess, Galloway [*R.A.M.*, xix, p. 613], and others.

RIÈRE (J.). **Molds: development, identification, prevention.**—*Amer. Dyest. Rep.*, xxix, 8, pp. 211–212, 1940.

This is an abstract of a paper published in *Rev. gén. Mat. col.*, 55, 1939, in which the following information is presented. Highly polymerized cellulose is attacked only by *Mucor* and *Aspergillus*. The general conditions requisite for the development of mould growth on textiles include humidity, absence of bright light, presence of nutrients, depletion of oxygen, a favourable hydrogen-ion concentration, and a temperature range of 20° to 40° C. Black *Aspergillus* [*A. niger* group] grows very slowly at 7°, rapidly at 37°, and not at all above 43°, the white species [?*A. candidus* group] develops most profusely at 25° and ceases to grow at 37°, while the optimum for the green *Penicillium* is 27°, development being arrested above 39°. Rayon, consisting of depolymerized cellulose [cf. *R.A.M.*, xviii, p. 564], is stated to be particularly subject to fungal infection, being completely transformed into glucose by enzymatic action affecting cotton to the extent of only 30 per cent.

Mildew growth liberates heat up to 70°, and this may aid in its detection. Microscopic examination is facilitated by the German practice of boiling in water, treating for a minute or two in a hot aqueous solution of phenol, lactic acid, and glycerine, and then immersing for several minutes in a solution of direct blue dye. After rinsing and re-heating in the lactophenol solution to remove excess of dye, the mildewed parts remain coloured and the fibres are ready for examination.

Among the most effective antiseptics may be mentioned salicylic acid, beta-naphthol [ibid., xviii, 56, *et passim*], aristol, the sodium salt of para-chlorometacresol [ibid., xix, p. 318], hexylresorcinol [loc. cit.], and emulsions of zinc or aluminium naphthenate. In this connexion it should be remembered, however, that every antiseptic is not equally effective against all moulds, *Fusarium*, for instance, having been known to develop on a starch mixing containing 10 per cent. zinc chloride, while one or two species of *Aspergillus* utilize salicylic acid. Boiling the fabric may counteract the incipient stages of mould growth, or light chlorination or treatment with 2 per cent. ammonia water may be tried, but even if the visible effects are removed, the weakening of the fibre and modification of its dye affinity will persist.

BULLER (A. H. R.). **The diploid cell and the diploidisation process in plants and animals, with special reference to the higher fungi. I. II.** —*Bot. Rev.*, vii, 7, pp. 335–387; 8, pp. 389–431, 1941.

Among the many aspects of diploidization covered by this valuable critical survey of the subject and related topics may be mentioned the introductory section on sexuality, homothallism, the path of nuclear migration in the higher fungi, haploidy, heterokaryosis in certain Pyrenomycetes and the rusts, discussions of (*a*) Dodge's views on sex and inheritance [*R.A.M.*, xix, p. 160], (*b*) the various systems of

terminology applied to the nuclear phase of the higher fungi, and (*c*) the 'Buller phenomenon', the diploidization of a haploid mycelium or structure by a diploid mycelium. An eight-page bibliography is appended.

GRAY (P. H. H.). **A solution for staining differentially the spores and vegetative cells of micro-organisms.**—*Canad. J. Res.*, Sect. C, xix, 4, pp. 95–98, 1941.

In this paper the author describes a single-solution staining method for the differentiation of spores and vegetative cytoplasm of bacteria, yeasts, and certain fungi, requiring no heating or subsequent decolorization or counterstaining. The solution consists of 0·50 per cent. malachite green and 0·05 per cent. basic fuchsin in distilled water. For use with *Aspergillus* and *Penicillium*, the solution is diluted with four times its bulk of 0·8 per cent. sodium chloride solution. In this form it is applied on a cover glass to colonies growing on agar plates.

FULTON (R. W.). **The behaviour of certain plant viruses in plant roots.**—*Phytopathology*, xxxi, 7, pp. 575–598, 4 figs., 1 graph, 1941.

At the Wisconsin Agricultural Experiment Station the behaviour was investigated of the tobacco mosaic, cucumber mosaic, potato ring spot, tobacco ring spot, severe etch, and tobacco streak viruses in the aerial parts and roots of various hosts, especially Havana seed tobacco and John Baer tomato. All viruses systemic in the aerial portions of the host plants were able to invade the roots 5 to 15 days after inoculation of the leaves.

Inoculation of the roots of the tobacco and tomato with several different viruses resulted in good root infection, but no infection of the aerial parts, the virus movement upward being very slow and restricted, whereas downward it was relatively rapid, corresponding to the rate of downward movement in the leaves and stems.

In contrast to the unidirectional movement observed in inoculated roots, the tobacco mosaic virus moved in both directions from an inoculation at the base of tomato stems [*R.A.M.*, xviii, p. 823]. In experiments to determine the effects of daily alternations of light and darkness on the movement of the virus in tomato plants inoculated at the stem bases, total darkness was found to prevent upward but permitted slow downward migration, whereas under constant illumination the virus travelled almost simultaneously in both directions. It was found possible to reverse the downward movement of the tobacco mosaic virus in darkened tobacco and tomato plants by immersion of the inoculated roots in a solution containing sugar, mineral salts, and yeast extract, strongly suggesting that the trend of virus movement in plant roots is determined by the position of supply of organic food materials.

Root extracts diluted 1 to 1,000 of tobacco and tomato plants infected with ordinary tobacco mosaic virus were found to be less infectious to tobacco foliage than leaf juice from the same plant, and experiments confirmed the observations by Stanley [ibid., xviii, p. 212] and Price [ibid., xii, p. 120] that the virus concentrations tend to be lower in the roots than in the leaves. Root extracts of healthy tobacco and tomato plants exerted a marked inactivating influence on the

tobacco mosaic virus, reducing the number of lesions on tobacco leaves inoculated from 928 and 661, respectively, for the virus and healthy leaf extract mixtures to only 71 and 174, respectively. It appears probable, therefore, that the inhibitory influence of healthy tobacco root extract is related to the low infectivity of the root extract of diseased plants.

The thermal inactivation points of the tobacco mosaic, cucumber mosaic, tobacco ring spot, and severe etch viruses produced in tobacco roots were several degrees lower than for the same material in the foliage, viz., 84°, 67°, 59°, and 57°, respectively, compared with 92°, 72°, 64°, and 60°, respectively, similar results being obtained with tobacco ring spot in sunflower, *Zinnia elegans*, *Calendula officinalis*, and cucumber. These data indicate that some property peculiar to the root extract reduces the heat tolerance of the virus.

JOHNSON (F.). **Transmission of plant viruses by Dodder.**—*Phytopathology*, xxxi, 7, pp. 649–656, 1 fig., 1941.

Successful transmission from diseased to healthy plants of the viruses of aster yellows, tomato bushy stunt, cucurbit mosaic, beet curly top, tobacco mosaic, and white clover [*Trifolium repens*] virus 1 [*R.A.M.*, xv, p. 274] was effected at the Rockefeller Institute for Medical Research, Princeton, New Jersey, by means of dodder (*Cuscuta campestris*). The healthy test plants were connected with diseased ones by one or more dodder stems 10 in. or more in length, or parasitized by 2 in. sections from the tips of dodder stems that had grown on infected hosts. The aster yellows virus was conveyed to 4 out of 50 plants of *Callistephus chinensis* and 6 out of 30 of *Nicotiana rustica* in periods of 40 and 35 days, respectively, and the white clover mosaic virus to broad beans (9 out of 12) and 5 out of 8 hop clover (*Medicago lupulina*) in 23 and 30 days, respectively. The remaining viruses were transmitted to their own hosts only as follows: bushy stunt (5 out of 20 in 23 days), cucurbit mosaic (7 out of 22 in 21 days), beet curly top (7 out of 16 in 19 days), and tobacco mosaic (13 out of 26 in 26 days).

The white clover virus 1 was found to consist of two distinct components, only one of which was transmissible to broad beans and *M. lupulina* by means of *Cuscuta campestris*, while the other was isolated in cowpeas by mechanical inoculation with juice from mosaic-diseased white clover. A combination of the two viruses produced typical streak symptoms on peas.

The dodder method of virus transmission is applicable to a wider range of diseases than grafting, but is less efficient and the incubation periods are longer than those required for mechanical or insect conveyance.

NICKERSON (W. J.) & THIMANN (K. V.). **The chemical control of conjugation in Zygosaccharomyces.**—*Amer. J. Bot.*, xxviii, 7, pp. 617–621, 4 figs., 1 graph, 1941.

In agar cultures of a species of *Zygosaccharomyces* [unspecified] contaminated with *Aspergillus niger*, conjugation of cells was found to be much more active than in pure cultures. It was concluded that *A. niger* secretes a conjugation-promoting substance into the medium.

In further experiments it was demonstrated that in four-day-old cultures of the *Zygosaccharomyces* sp. grown on fresh malt extract broth only 12 per cent. of the cells were conjugating as compared with 71 in cultures of the same age grown on a filtrate of *A. niger*. The conjugation-promoting substance was fully soluble in 90 per cent. alcohol, but insoluble in acetone or chloroform. In the absence of *A. niger* conjugation was more active in old pure cultures of the *Zygosaccharomyces* sp. than in younger ones. Extract from a culture of the *Zygosaccharomyces* prepared in the same way as the *A. niger* filtrate also promoted conjugation, but was somewhat toxic or inhibitory at high concentrations, while *A. niger* extracts showed no such effects. The presence of *A. niger* had a conjugation-promoting effect on the cultures of two other species of *Zygosaccharomyces*.

Saksena (R. K.). **Importance of growth-promoting substances in the metabolism of Pythium indigoferae Butler.**—*J. Indian bot. Soc.*, xx, 4, pp. 183–189, 1941.

In a cultural study of *Pythium indigoferae* [*R.A.M.*, xv, p. 244] it was shown that the fungus is able to grow on a synthetic medium containing peptone or hydrolysed peptone as the source of nitrogen, but not on one containing various amino acids. The organism did not respond to thiamin, but required for growth an extraneous supply of growth-promoting substances such as are present in casein extract, lentil extract, or yeast.

Storey (I. F.). **A comparative study of strains of Rhizoctonia solani (Kuhn) with special reference to their parasitism.**—*Ann. appl. Biol.*, xxviii, 3, pp. 219–228, 1 pl., 4 graphs, 1941.

The results of cross-inoculation experiments with 13 different strains of *Rhizoctonia* [*Corticium*] *solani* showed that some strains have a very restricted host range while others are less markedly specialized. The strains isolated from potato and one from tomato attacked only solanaceous hosts, whereas another tomato strain was pathogenic to lettuce as well as tomato. Isolates from cruciferous plants attacked only these hosts. Isolates from the composites lettuce and zinnia infected only these, while the endive strain attacked swede but not lettuce or any other test host. The strain from beet was unable to attack any of the plants used and those from cotton and grass were capable of attacking both cruciferous and solanaceous hosts. These results were obtained by a technique which involved the addition to the soil of not more than 0·1 per cent. organic matter. When varied amounts of inoculum were applied to a soil maintained at 60 per cent. of its water-holding capacity, inocula of high organic content markedly inhibited the germination of swedes owing, it is thought, to some toxic chemical effect. From a study of the behaviour of the potato 1 and radish isolates on susceptible and non-susceptible hosts, it appeared that the resistance of crucifers to the isolates from potato was correlated with the presence of a substance which inhibited the growth of the fungus, while the appropriate strain was able to tolerate it. When cultured on autoclaved plugs of potato tuber and swede root tissue, each of the potato and radish strains secreted pectinase enzyme most

actively when grown on plugs of the appropriate host; the maximum enzymic activity was produced by the potato strain in 5 as against 15 days needed by the radish strain, and this effect obtained on either host. The action of the crucifer strain of the fungus was almost completely inhibited on blocks of turgid swede tissue as compared with that on subturgid blocks, but the enzyme was more active on the former.

Bald (J. G.) & Norris (D. O.). **Obtaining virus-free Potatoes.**—*J. Coun. sci. industr. Res. Aust.*, xiv, 3, pp. 187–190, 1941.

The authors state that it may be assumed that more than 90 per cent. of the potatoes grown in Australia are infected by virus X [*R.A.M.*, xviii, p. 656]. If this virus could be eliminated, the yield would be so increased that about four-fifths of the present potato area would suffice. The losses from virus X appear to be at least as heavy as those from all other virus diseases combined, and probably amount in cash to £350,000 a year.

In 1936, the senior author succeeded in finding one plant of the principal New South Wales variety, Factor (Up-to-Date), which appeared to be unaffected. It was protected from infection in the field, was harvested early, and bore 13 tubers. This stock, though also unaffected, was found to carry the leaf roll virus.

A second attempt to find a virus-free Factor plant was begun in 1940 with 960 tubers from a grower of certified seed in New England, [New South Wales]. During several months, inoculations were made from each tuber to pepper [? *Capsicum annuum*] or Epicure potato plants. By the end of November, 1940, 28 plants had caused no reaction, all the others being proved to contain virus X. The 28 tubers were then cut in half, and one lot returned to the original grower in New England to be planted in an isolation plot, while the other lot was similarly planted at Uriarra, about 20 miles from Canberra. While the inoculations were in progress, a single eye was cut from each tuber and planted in a pot in the greenhouse. Further inoculations were made, and eliminated all but 13 tubers. In February, 1941, a detailed examination of the plants in the New England plot demonstrated 13 to be virus-free; the same number also showed freedom from all virus infection at Uriarra.

Further experiments left no doubt that most, and probably all, of these 13 plants are free from virus X. The healthy appearance of the plants when growing under good conditions and their high yield in an infertile soil encourage the belief that ten at least are free from any virus infection. They form the basis of a possible virus-free stock to replace the infected stocks at present grown.

Bald (J. G.). **Potato virus diseases, the scientist and the farmer.**—*Fruit World, Melbourne*, xlii, 6, pp. 17–18; 7, pp. 17–18, 1941.

In these popular notes on potato virus diseases in Australia the author states that the tomato spotted wilt virus is important on potatoes in the Adelaide Plains and in the Mount Lofty Ranges. The virus causes collapse and death of the young tissues. It passes into the tubers and if they are young causes dead spots, cracking and distortion resulting when the unaffected portions of the tubers continue to grow.

It is not known how often infected tubers will give diseased plants, but it is known that shoots from such tubers die back and the tubers 'miss'.

The principles of control by certification are discussed, and the paper concludes with recommendations for the maintenance of seed plots. The policy of controlling leaf roll and mosaic by certification while discounting the ubiquitous potato virus X [see preceding abstract] is considered sound at the present time.

Bald (J. G.). **A report on agricultural features of the Australian Potato industry.**—*Pamphl. Coun. sci. industr. Res. Aust.* 106, 72 pp., 2 graphs, 2 maps, 1941. [Photo-lithographed.]

In the section on potato diseases of this report (pp. 42–58) it is stated that the losses due to diseases (excluding latent mosaic) and pests in Australia approach or exceed 20 per cent. of the potential total yield, entailing the virtual waste of 25,000 acres of each season's planting or 65,000 tons of the production. The most important diseases are those caused by viruses, *Rhizoctonia* [*Corticium solani*], *Actinomyces scabies*, and *Spongospora subterranea*, wilts (*Verticillium albo-atrum* and *Fusarium* spp.), tuber rot (*Pythium de Baryanum*), and early and late blights (*Alternaria solani* and *Phytophthora infestans*); early blight is more widespread and on the whole more troublesome than late, epidemics of which are rare except in northern New South Wales and Queensland.

The following conservative estimates have been computed for percentage losses incurred through preventable virus diseases (comprising all except latent mosaic) in the most widely grown varieties: Carman 31, Brownell (Satisfaction) 26, Up-to-Date (Factor) 18, Snowflake 4, Delaware 6, Bismarck 8, and miscellaneous 7.

Nattrass (R. M.). **Notes on plant diseases.**—*E. Afr. agric. J.*, vii, 1, p. 56, 1 pl., 1941.

Napier grass (*Pennisetum purpureum*) in Kenya is frequently affected, especially during the rainy season, by white mould due to *Beniowskia sphaeroidea* [*R.A.M.*, xvi, p. 796]. The fungus is common throughout East Africa, readily attacking both varieties of Napier grass, and sometimes occurring on other grasses, including *P. clandestinum*. The effect of infection is very localized, and moderate attacks have little effect on plant vigour. In severe infection, browning of the leaves from the tips may be present; in such cases, it may be advisable to cut down the growth.

Recent heavy losses in shipments of potatoes from South Africa are stated to be probably due in large part to black heart [ibid., xviii, p. 134] induced by oxygen deficiency. Immature tubers may become affected even under open-air conditions if exposed to temperatures of 38° C. or over. Care should be taken when lifting potatoes to ensure that they are not exposed to the direct rays of the sun, particularly if immature potatoes are being dug, as may occur during a shortage. Adequate ventilation is essential during transit, even if only a short journey is involved. The Tinwald Perfection and Duke of York varieties are resistant, whereas Majestic is highly susceptible. The popularity of the Italian white potato on the Indian market is largely

due to its resistance to high temperatures. Affected tubers should not be planted.

Nisikado (Y.) & Kimura (K.). **A contribution to pathological anatomy of Rice plants affected by Gibberella fujikuroi (Saw.) Wollenweber. I.**—*Ber. Ōhara Inst.*, viii, 4, pp. 421–426, 2 pl., 2 graphs, 1941.

The microscopic examination of the culms of rice plants suffering from the 'bakanae' (elongation) disease caused by *Gibberella fujikuroi* in Japan [*R.A.M.*, xx, p. 491] disclosed the presence of the mycelium and microconidia in the vascular bundles, the large pitted vessels and lacunae of the xylem being extensively occupied, while the phloem and soft parenchyma cells were invaded only in a few severely damaged culms. Apparently healthy parts of affected plants may contain mycelium and microconidia. Macroconidia were usually observed only in cases of advanced infection on the inner side of the leaf sheaths near the node. Details are given of the distribution of the mycelium in relation to the position of the nodes as revealed both by microscopic and cultural methods, the results of which were generally in agreement except that the latter indicated discontinuity in the development of the fungus along two of the four test plants, mycelium being present in one up to a point above the third node, at which it disappeared, to resume growth above the fifth, while in another the mycelium was absent from a point just above the second to the sixth node, inclusive, reappearing above the seventh and eighth. Such interruptions probably reflect the ordinary course of infection in nature.

**South American leaf spot disease of Hevea.**—*Rep. Canal Zone exp. Gdns, 1940*, pp. 28–29, 1941.

So far it has not been possible to trace the origin of the epidemic of South American leaf spot disease (*Dothidella ulei*) of *Hevea* rubber [*R.A.M.*, xx, p. 223] in Panama, which coincided with the commencement of planting operations by the Goodyear Rubber Company near Gatun Lake in 1935. The Company's material was all obtained either from the Philippines, where *D. ulei* is unknown, or from the Canal Zone Experiment Gardens, in which the first outbreak of infection occurred in 1939. Some of the several thousands of seeds introduced from Haiti in 1931 and planted in an isolated site near Summit are now badly infected by the fungus, though apparently healthy at a previous inspection in 1938. It is suspected that many of the trees, e.g., members of the large family of the Euphorbiaceae, in Panama forests may harbour the pathogen, and all species of the 25 genera of this family at least should be investigated as potential hosts.

Riceman (D. S.), Donald (C. M.), & Evans (S. T.). **Further investigations on copper deficiency in plants in South Australia.**—*Pamph. Coun. sci. industr. Res. Aust.* 96, 44 pp., 10 pl., 1940. [Photolithographed.]

The results of further investigations on the mineral nutrition of plants in the calcareous sandy soils along the South Australian coast amply confirmed previous observations on the severe copper deficiency [reclamation disease] obtaining in these areas [*R.A.M.*, xviii, p. 163].

Subterranean clover [*Trifolium subterraneum*] grown on the soil in question in 4 kg. pots responded favourably to the application both of iron (57·5 or 230 mg. ferrous sulphate, equivalent to 28 and 112 lb. per acre, respectively) and copper (20·6 or 165 mg. = 10 and 80 lb., respectively). The maximum yields of oats and wheat were secured by the incorporation with the soil of 14 to 56 lb. copper sulphate per acre, no further increases resulting from treatment with manganese, iron, or nitrogen. Potash, however, at the rate of 112 lb. per acre (potassium sulphate) increased the grain and straw yields of oats by 151 and 310 lb., respectively, where copper sulphate had already been applied in doses of 56 lb. per acre. Late applications (29th September, 1938) of copper sulphate to a crop of oats showing typical 'wither tip' and foliar limpness resulted in rapid recovery.

A vigorous six-acre pasture of black medick (*Medicago lupulina*) and Wimmera rye grass (*Lolium* sp.) was established in 1937–8 by the use of copper sulphate at the rate of 17 lb. per acre. The copper contents of the grain and straw of plants exhibiting severe copper deficiency symptoms ranged from 1 to 3 mg. per kg. dry matter.

Waksman (S. A.) & Woodruff (H. B.). **Actinomyces antibioticus, a new soil organism antagonistic to pathogenic and non-pathogenic bacteria.**—*J. Bact.*, xlii, 2, pp. 231–249, 3 figs., 1941.

This is an expanded account of *Actinomyces antibioticus*, the soil antagonist of fungi and bacteria recently discovered at the New Jersey Agricultural Experiment Station [*R.A.M.*, xx, p. 322, where 'ether' in l. 23 should read 'petrol ether'], accompanied by a technical diagnosis [in English only]. The separation of actinomycin into two fractions, A and B, was effected by the use of petrol ether, only B being soluble.

Ulbrich (E.). **Der Blasenbrand der Helleborus-Arten.** [The blister blight of *Helleborus* spp.]—*Notizbl. bot. Gart. Berl.*, xv, pp. 62–67, 1940. [Abs. in *Zbl. Bakt.*, Abt. 2, ciii, 18–20, p. 373, 1941.]

The controversial problem of the terminology of the blister blight of *Helleborus* spp. is discussed, the author's conclusion being that the only valid name for the fungus is *Urocystis pompholygodes* (Schlechtd.) Rabenh., a complete list of synonyms being appended. The geographical distribution of the pathogen and its occurrence on the different species of hellebore are reviewed.

Reichert (I.). **Stem blight of the Castor Bean.**—Reprinted from *Palest. J. Bot.*, R Ser., iii, 1–2, 4 pp., 1 fig., 1940.

*Fusarium orthoceras* and *F. semitectum* were isolated from the blackened and decayed roots of castor beans (*Ricinus communis*) suffering from wilt at Ashdot Ya'aqov in the Jordan Valley, where the plant is used as a windbreak in banana and orange plantations, this being the first record of the former organism on the host in question [cf. *R.A.M.*, xix, p. 675], whereas the latter has already been reported from Italy [ibid., xvii, p. 135]. The disease causes heavy damage, which is increasing annually; in 1937 some 35 per cent. of the plants were affected, while in 1939 only a few remained healthy in a hedge of about 5,000. Inoculation tests are necessary to determine the relative

importance of the two species in the etiology of the disease, but in the meantime the formation of sporodochia on the stem points to *F. orthoceras* as the principal pathogen, these organs not being produced by *F. semitectum*. *Diplodia natalensis* frequently develops under the bark of plants in an advanced stage of wilt, but its part in the etiology of the disease has not yet been ascertained.

RAFAY (S. A.) & PADMANABHAN (S. Y.). **Sugarcane smut in Bihar.**—*Curr. Sci.*, ix, 11, pp. 496–497, 3 figs., 1940.

Sugar-cane smut was observed in Bihar in 1940 before, instead of after, the monsoon, and in fresh localities. During July, interesting examples of spike formation [which are described] were encountered in the five-months-old crop. Spores from collections in several localities closely agreed with those of *Ustilago scitaminea* [*R.A.M.*, xx, p. 135], but one collection from Buxar resembled *U. scitaminea* var. *sacchari-barberi* [ibid., xix, p. 238].

ABBOTT (E. V.) & TIPPETT (R. L.). **Myriogenospora on Sugar Cane in Louisiana.**—*Phytopathology*, xxxi, 6, pp. 564–566, 1 fig., 1941.

The symptoms of stunted C.P. 28/19 sugar-cane plants observed near Raceland, Louisiana, with whip-like foliage, the tips of the unfolding leaves being held firmly down along the midrib of its predecessor by a black fungal stroma, agreed with those characteristic of infection by *Myriogenospora aciculisporae*, hitherto reported only from the Argentine and Brazil [*R.A.M.*, xviii, p. 624], while the ascospore measurements and other features of the pathogen also corresponded with Vizioli's diagnosis [ibid., vii, p. 537]. Possibly, however, the species under observation may be identical with that detected by Diehl on *Andropogon* and tentatively referred to *M. paspali* [ibid., xiii, p. 706].

MOESZ (G. v.). **Fungi Hungariae. IV. Basidiomycetes—Pars 1. Uredineae.** [Fungi of Hungary. IV. Basidiomycetes—Part 1. Uredineae.]—*Ann. Mus. nat. Hung.*, Pars bot., xxxiii, pp. 127–200, 1940. [Hungarian, with German summary and annotations.]

This critically annotated list comprises over 150 species of rusts out of a total of more than 400 stated to occur in Hungary, among those of special interest being six species of *Gymnosporangium* on juniper and pomaceous hosts; *Phragmidium rubi-idaei* [*R.A.M.*, xix, p. 567] on raspberry; *Puccinia agrostidis* on *Agrostis alba* (aecidia on *Aquilegia vulgaris*); *P. antirrhini* on *Antirrhinum majus*; *P. apii* on celery; *P. arrhenatheri* on *Arrhenatherum elatius* [*A. avenaceum*] (aecidia on barberry) [ibid., xii, p. 536]; *P. cichorii* on chicory [ibid., ix, p. 503]; *P. helianthi* on sunflower and artichoke (*Helianthus tuberosus*); *P. malvacearum* on various Malvaceae, including *Althaea officinalis*; and *P. mentha* on *Mentha* spp., including *M. longifolia* and *M. piperita*, *Origanum vulgare*, and *Satureia vulgaris*.

HANSFORD (C. G.). **Contributions towards the fungus flora of Uganda. III. Some Uganda Ascomycetes.**—*Proc. Linn. Soc. Lond., 1940–41*, 1, pp. 4–52, 12 figs., 1941.

This critically annotated list of over 300 Ascomycetes continues the

author's earlier paper on the fungal flora of Uganda [*R.A.M.*, xvii, p. 415], a supplement to which appeared in *J. Linn. Soc.* (*Bot.*), li, 340, pp. 537–545, 1938. The present list comprises 11 species of *Elsinoe*, of which seven are new, including *E. piperis*, while *E. tephrosiae* [*R.A.M.*, xvii, p. 297] receives an amplified description. Other interesting records are *Oidium caricae* on papaw, *Uncinula necator* on vine, *O. tingitaninum* on *Aegle marmelos*, *Ceratostomella paradoxa* causing finger-tip rot of bananas, *Paranectria hemileiae* n.sp. on sori of *Hemileia vastatrix* on coffee leaves (among other hyperparasites described), *Claviceps digitariae* n.sp. on *Digitaria scalaris*, and *Dictyopeltis consimilis* on *Balsamocritus* sp.

AINSWORTH (G. C.). **Contributions towards the fungus flora of Uganda. IV. The Ustilaginales of Uganda.**—*Proc. Linn. Soc. Lond., 1940–41*, 1, pp. 92–97, 1941.

This critically annotated list of 25 Ustilaginales from Uganda [see preceding abstract] includes three new species, as well as *Entyloma australe* on *Physalis peruviana*, *E. dahliae* on cultivated *Dahlia*, *Sorosporium reilianum*, *Sphacelotheca cruenta*, and *S. sorghi* on sorghum, *Ustilago kamerunsis* on *Pennisetum purpureum*, and *U. tritici* on wheat.

CUMMINS (G. B.). **Uredinales of New Guinea—IV.**—*Mycologia*, xxxiii, 4, pp. 380–389, 3 figs., 1941.

This list of 28 species (13 new) of Uredinales collected by Mrs. M. S. Clemens in Morobe District, New Guinea [*R.A.M.*, xix, p. 616], comprises *Uromyces phaseoli* [*U. appendiculatus*] on bean (*Phaseolus vulgaris*), and two new species, *Uredo passiflorae* on *Passiflora* sp. and *U. pseudocannae* on *Canna indica*.

DRECHSLER (C.). **Three species of Pythium with proliferous sporangia.**—*Phytopathology*, xxxi, 6, pp. 478–507, 13 figs., 1941.

Continuing his studies on the genus *Pythium* [*R.A.M.*, xix, p. 435], the writer gives additional details of *P. oedochilum* found associated with diseased dahlia roots (and subsequently discoloured *Bidens aristosa* roots) and *P. palingenes*, first described in 1930 [ibid., x, p. 211] from discoloured roots of *Ambrosia trifida*. A detailed account is also given of *P. marsipium* n.sp. which, together with *P.* (?) *proliferum* and *P.* (?) *undulatum*, was found associated with water-soaked or discoloured areas on the foliage of white water lilies (including *Nymphaea odorata* and *N. tuberosa*) in the northern United States.

HARTER (L. L.). **The personal element and light as factors in the study of the genus Fusarium.**—*J. agric. Res.*, lxii, 2, pp. 97–107, 1941.

In continued studies on *Fusarium martii* var. *pisi* and *F. bulbigenum* var. *batatas* [*R.A.M.*, xviii, p. 609], a statistical analysis of results showed that conidial measurements taken by different investigators from the same microscopic preparation of the same species may vary considerably when groups of 50 spores are counted, but that 150 to 200 measurements may be taken to represent a fairly reliable sample of a population provided the spore suspensions are carefully prepared and mounted. There was no significant difference in the ratio of three,

four, and five septations of the conidia in different microscope mounts made from the same spore suspension, but highly significant differences sometimes occurred between culture tubes of the same species grown on the same medium. It is concluded, therefore, that a single tube culture is not representative of a number of tube cultures. Exposure to light was found to increase the size and number of septations of the conidia, those with one or two septa being predominant and those with four or five either rare or entirely lacking in cultures grown in the dark, while conidia with four or five septa were predominant and abundant in cultures exposed to irradiation by a 200-watt Mazda lamp at a distance of 26 in.

ULBRICH (E.). **Über die Tilletiaceen-Gattungen Tuburcinia Fr. 1832, Urocystis Rbh. 1856 und Ginanniella Ciferri 1938.** [On the genera of the Tilletiaceae *Tuburcinia* Fr. 1832, *Urocystis* Rbh. 1856, and *Ginanniella* Ciferri 1938.]—*Notizbl. bot. Gart. Berl.*, xv, pp. 68–84, 1940. [Abs. in *Zbl. Bakt.*, Abt. 2, ciii, 18–20, p. 372, 1941.]

The author fully discusses the terminological problems affecting the validity of the generic names *Urocystis* and *Tuburcinia*, and shows that Liro's conception of the scope of *Tuburcinia*, involving as it would the re-naming of practically every species of *Urocystis*, is at the very least highly problematical; the retention of the generic name *Urocystis* Rabenhorst 1856, with the type species *U. occulta* (Wallr.) Rabenh. 1856, is therefore recommended as a *nomen conservandum* [*R.A.M.*, xix, p. 567]. Fries's hybrid genus *Tuburcinia* might be retained for the single species, *T. orobanches*, comprised therein. In this latter species the spore balls, composed as in *Urocystis* of a few, usually one to three, individual spores, are enveloped in a thick, sometimes two-layered sheath of accessory cells, preventing their disintegration, in contrast to *Urocystis*, in which there is no protective membrane to unite the separate spores. In recognition of these morphological differences as a generic character, the genus *Tuburcinia* Fries 1832 em. Ulbrich would be maintained with *T. orobanches* (Mérat) Fr. 1832 as the type and hitherto sole known species. All species with non-disintegrating spore balls composed of numerous (10 to 70) flattened individual spores and producing a mycelial-conidial generation should be referred to the genus *Ginanniella* Ciferri 1938 em. Ulbrich with the type species *G. trientalis* (Berk. & Br.) Cif. 1938 [ibid., xvii, p. 842]. Three species are added to the last-named genus, for which a more detailed diagnosis is given.

WOLLENWEBER (H. W.). **Diplodia sarmentorum Fries und ihre Verbreitung.** [*Diplodia sarmentorum* Fries and its distribution.]—*Zbl. Bakt.*, Abt. 2, ciii, 18–20, pp. 347–357, 1941.

*Diplodia sarmentorum* [*R.A.M.*, xvi, p. 335] is here identified from published exsiccata on about 150 host plants belonging to 100 genera, and is held to have been described under nearly 150 different specific names, nearly all from European material. The author has collected and inoculated it on *Menispermum* (the type host), pear, lime (*Tilia*), elm, *Sophora*, and *Cydonia*. His cultures formed pycnidia freely, and those isolated from the first four were inoculated into apple and quince

fruit, causing a rot but much more slowly than isolations of *D. pseudodiplodia*, *D. rudis*, *D. gallae*, *D. mutila*, and *D. palmicola*. The pycnidia are stated to be scattered, glistening, black, and 0·2 to 0·4 mm. in diameter; the spores bicellular, dark brown, and either subcylindrical and rounded at both ends, or oval and rather constricted. The mean measurements are 22 by 10 $\mu$, with a usual range of 21 to 25 by 9 to 11 $\mu$ and an extreme range of 18 to 29 by 7·5 to 15 $\mu$. The other species of *Diplodia* mentioned above can be separated by the mean measurements of their pycnospores.

Singer (R.). **Is Shiitake a Cortinellus?**—*Mycologia*, xxxiii, 4, pp. 449–451, 1941.

Discussing the taxonomic position of the edible fungus 'shiitake', the author states that it cannot be included in *Cortinellus* [cf. *C. shiitake*: *R.A.M.*, xviii, p. 434] because it does not resemble *C. bulbiger*, to which, according to the modern conception, this genus is restricted; nor is it a *Cortinellus* of the *Tricholoma vaccinum* type, from which it differs in the structure of the hyphae and its growth on wood. On the other hand, all diagnostic characters are considered to point to *Lentinus* and the mushroom is consequently renamed *L. edodes* (Berk. non Schröt.) Singer, comb. nov. [? syn. *Agaricus* (*Armillaria*) *edodes*: ibid., xv, p. 684]. The 'matsutake' fungus [known as *Armillaria matsutake*: loc. cit.] is regarded as a form of the *T. caligatum* group, and perhaps identical with that species.

Gadd (C. H.). **Report of the Mycologist for 1940.**—*Bull. Tea Res. Inst. Ceylon* 22, pp. 32–38, 1941.

In this report [cf. *R.A.M.*, xix, p. 677] the author states that in April and May, 1940, he received specimens of *Albizzia* seedlings from the Balangoda and Bimbula districts of Ceylon showing the leaf disease reported by Petch in 1914 from the Ratnapura area as caused by a fungus which he later named *Ceratophorum albizziae* [cf. ibid., xviii, p. 282]. All the specimens were seriously defoliated, and the leaflets that remained on the plants showed pale brown spots caused by the fungus, which was also present on the fallen leaves. The only treatment consists in preventive spraying with a copper fungicide before serious damage has been done.

Scab, though seldom of economic importance, is often found on the older leaves of tea bushes, but seldom, if ever, affects the flush. Affected leaves fail to attract attention until the condition has reached an advanced stage, when characteristic scabs appear on the upper surface of the leaves. They are large, irregular, intermingled black and grey, irregularly blistered and cracked and frequently extend over a great part of the leaf. The discoloration does not generally affect the under surface of the leaves. The condition is associated with *Elsinoe theae* [ibid., xix, p. 369].

Bond (T. E. T.). **Report of the Assistant Mycologist for 1940.**—*Bull. Tea Res. Inst. Ceylon* 22, pp. 39–42, 1941.

In this report the author states that phloem necrosis has now been found on 113 tea estates in Ceylon [*R.A.M.*, xix, p. 677], and only on

five occasions has it been identified at elevations under 4,000 ft. As a rule, a reliable diagnosis can be made from an inspection of the bush and an examination of a few leaves cut or broken off at the petiole. Rate of spread varies in different localities, but may be extremely rapid. In one large plot in the Kandapola area, the percentage of affected bushes has doubled in two years, the last record giving 524 necrotic bushes out of 985, or 53 per cent. affected. The evidence indicates that several years may pass before severe symptoms develop, and it may be even two years before a reliable diagnosis can be made. At St. Coombs, and probably in most areas of low altitude, spread in the field is relatively slow, and may affect only 5 per cent. of the bushes every year. At the lower altitudes also, the effects are less conspicuous, and it is frequently difficult to identify the condition without microscopic examination. Statistical data show that the disease, in addition to a random dispersal, shows a distinct tendency to spread from bush to bush along and across the rows. The continued absence of the disease from young plants of the high jat type suggests that these, at least, are strongly resistant. There is no evidence that transmission can occur mechanically, i.e., by needle prick or the transfer of inoculum by plucking or pruning. The disease appears to have been transmitted by grafting [ibid., xviii, p. 712], though not in its typical form.

Investigation of the distribution of necrotic symptoms in the shoot revealed that the banji shoot is usually necrotic throughout, including the apical bud. As the bud expands and the new flush develops, the necrosis is at first confined to the base (the region of the fish leaf), and only when the rate of plant growth declines is it observed to spread. The apex again becomes necrotic soon after the flush growth ceases.

Valleau (W. D.). **Experimental production of symptoms in so-called recovered ring-spot Tobacco plants and its bearing on acquired immunity.**—*Phytopathology*, xxxi, 6, pp. 522–533, 3 figs., 1941.

Six strains of the tobacco ring spot virus of diverse origin were found in studies at the Kentucky Agricultural Experiment Station in 1939–40 to be distinct, and in this connexion attention is drawn to the inapplicability of Holmes's proposed Latin trinomial system of nomenclature [*R.A.M.*, xix, p. 229] to each new strain in complex diseases of this type. Kentucky No. 16 Burley tobacco plants ostensibly 'recovered' from the ring spot stage of infection induced by five of the six strains developed conspicuous foliar chlorosis and necrosis when exposed to a temperature of 20° C., in contrast to the practically normal growth made at 26°, indicating that no real 'recovery' from ring spot as claimed by Price [ibid., xix, p. 487] takes place, the plants merely entering upon a new phase of the disorder [ibid., xiv, p. 402]. All six strains caused pollen sterility, entailing a heavy reduction in the quantity of seed harvested, so that if fertility were the principal criterion of health, a spurious 'recovery' of the kind described would not be recognized. So-called 'recovered' plants, moreover, are not immune from reinfection by a more virulent strain of ring spot. There is no conclusive evidence that infection with one ring spot strain confers immunity from others and the phenomenon is considered to be explicable on the basis of competition between different strains.

LAUFFER (M. A.) & DOW (R. B.). **The denaturation of Tobacco mosaic virus at high pressures.**—*J. biol. Chem.*, cxl, 2, pp. 509–518, 1 graph, 1941.

Tobacco mosaic virus nucleoprotein was exposed to pressures between 5,000 and 10,000 kg. per sq. cm. at 30° C., and found to be almost completely inactivated, gauged by the reactions to inoculation of bean (*Phaseolus vulgaris*) leaves, at about 7,500 kg. per sq. cm., a result agreeing with previous observations along the same lines [*R.A.M.*, xvii, p. 562]. At such exposures, varying amounts of an inactive coagulum were formed, the maximum quantity being produced between 6,000 and 8,000 kg. per sq. cm. The coagulum contained only a small amount (0·09 to 0·17 per cent.) of phosphorus, indicating that nucleic acid was liberated in the process of denaturation of the virus at high pressures. Experimental evidence was obtained that the pressure denaturation of the tobacco mosaic virus is a complex reaction.

FOSTER (H. H.). **Notes on Tobacco diseases in Puerto Rico.**—*Plant Dis. Reptr*, xxv, 8, pp. 238–242, 1941. [Mimeographed.]

The causal organism of black shank, *Phytophthora parasitica* [var.] *nicotianae*, is stated to be the most important pathogen of seed-bed and field tobacco in Puerto Rico [*R.A.M.*, xii, p. 402], infection in a recent varietal test amounting to 94·7 per cent. in the mosaic-resistant No. 34, while the corresponding figures for No. 64 (Venezuela), Pennsylvania Broadleaf, Utuado X No. 1, and Virginia No. 9, and No. 44 (mosaic-resistant) were 75, 34·4, 23·6, and 15 per cent., respectively. On the other hand, 301 from Florida was extremely resistant, only one plant out of 18 contracting infection, while Rg (Florida), Ambalema (Colombia), and Nos. 41, 50, and 54 remained free from attack. No. 41, combining resistance to black shank and mosaic, is a specially promising selection, and the cultivation of No. 44 is also to be continued, but No. 34 has been discarded.

During the past season, a number of superior strains of Ambalema, carrying systemic mosaic infection in a masked form but exhibiting a degree of resistance [ibid., xiv, p. 660] of the class 1 or 2 order [ibid., xvii, p. 629], were selected for further back-crossing with very encouraging results.

The 'mottle' virus reported by Nolla in 1937 (*Rep. Tob. Inst. P.R.*, pp. 23–25), and since observed on several occasions by the writer and others, induces pronounced vein-clearing of the younger leaves 7 to 10 days after inoculation, followed by yellow mottling of the interveinal areas. When developing in conjunction with mosaic, the mottle virus contributes to severe foliar malformation and chlorosis and stunting of the plants.

GHIMPU (V.). **Bolile și insectele dăunătoare Tutunului: Partea I. Partea III.** [Diseases and insects injurious to Tobacco. Part I. Part III.]—*Bult. Cult. Ferment. Tutun.*, xxix, 2 (*Supl.*), pp. 1–80, 1 col. pl., 23 figs., 1940; xxx, 1 (*Supl.*), pp. 253–342, 42 figs., 1941.

This is a fully documented, critical survey of the bacterial, fungal, virus, and physiological diseases affecting seed-bed and field tobacco

in Rumania [*R.A.M.*, xix, p. 307], with explicit directions for their control.

Matsumoto (T.). **Serological studies on the distribution and concentration of Tobacco mosaic virus in host plants. I. Measurements of virus after 2–4 days. II. Measurements of virus 5–14 days after inoculation.**—*Trans. nat. Hist. Soc. Formosa,* xxxi, 212, pp. 201–215; 213, pp. 275–285, 1 fig., 2 diags., 1941.

The writer's serological (precipitin) method was found to be applicable to studies on the distribution and relative concentration of the tobacco mosaic virus in its hosts [*R.A.M.*, xv, p. 403; cf. also xvii, p. 124], a fully tabulated description of which is given.

The virus first accumulates in measurable quantities in the inoculated leaf of a young potted tobacco plant two days after inoculation, and then migrates to the top and roots, which are usually reached almost simultaneously [ibid., xii, p. 791; xiii, p. 660; xviii, p. 823], though occasionally migration proceeds only upwards and still less frequently only downwards. On the third day after inoculation a certain amount of virus is detectable in the stem, but not until the fourth does the virus begin to appear in the leaf below the inoculated one. Small quantities of the virus are also found at this stage in the leaves above that inoculated. From the fourth to the seventh day the virus is more abundant in the growing points of the plants than in the inoculated foliage, but during the next week the amount of inoculum in the leaves increases until it equals, or in some cases exceeds, the quantity in the growing points. When the inoculation is made on older leaves there is less increase in the virus content in either the inoculated leaf or those immediately above. The concentration of the virus appears to be slightly higher in the tops than in the roots of infected plants, but the difference is not marked.

Köhler (E.). **Desinfektionsversuche an Rohsäften des Tabakmosaik- und des Kartoffel-X-Virus.** [Disinfection experiments on crude juices of the Tobacco mosaic and Potato X virus.]—*Zbl. Bakt.*, Abt. 2, ciii, 18–20, pp. 325–334, 4 graphs, 1941.

In experiments at the Biological Institute, Dahlem, Berlin, to determine the efficacy of various substances as disinfectants against the crude juices of the tobacco mosaic and potato X viruses, 1 per cent. sodium lye and 1 per cent. potash lye were found to destroy almost simultaneously both viruses in high concentrations on the leaves of *Nicotiana glutinosa* and Samson tobacco without appreciable damage to the inoculated tissues, and should be of practical utility to growers, combining economy with safety to man and domestic animals. Trypoflavin, eosin, and erythrosin exerted no inhibitory influence worthy of mention on the two viruses under observation, while their deleterious effects on the treated leaf areas were considerable, especially in the case of Samson; and the action of uranin (fluorescein sodium) was insufficient.

Kassanis (B.). **Transmission of Tobacco etch viruses by aphides.**—*Ann. appl. Biol.*, xxviii, 3, pp. 238–243, 1941.

The tobacco severe etch virus [*R.A.M.*, xx, p. 500] was transmitted

by *Myzus persicae*, *M. circumflexus*, *Aphis rhamni*, *A. fabae*, and *Macrosiphum gei*. The virus content of sap from mild etch-infected plants was considerably lower than that from plants infected by severe etch, yet both viruses were transmitted to the same extent by *Myzus persicae*. The percentage of infection was greatest when aphids were starved for four hours or more and then fed on the infective plants for two minutes; it was also greatly increased by keeping the starved aphids at a low temperature. Continuous feeding on healthy or diseased plants rendered the vectors less efficient and reduced the period of their infectivity from about three hours to 15 minutes. Allowed short feeding periods of two to three minutes on each plant, one insect may infect up to four plants, but it was observed that an aphid may fail to infect from one to four plants and then infect the next; others transmitted on the first day but not on the second, or on the second but not on the first, and still others on both days. It is suggested that the failure to obtain 100 per cent. infection in transmission tests with single aphids is not due to the inability of individuals to transmit, but possibly to some other unknown factor. The great increase in the percentage of infectivity obtained by using starved insects given a short infective feeding is best explained by the inactivation of the virus by a proteolytic enzyme secreted by the aphids in greater quantity while feeding than while fasting, as suggested by Mrs. M. A. Watson in the case of *Hyoscyamus* virus 3 [ibid., xvii, p. 344].

SHEFFIELD (F[RANCES] M. L.). **The cytoplasmic and nuclear inclusions associated with severe etch virus.**—*J. R. micr. Soc.*, Ser. III, lxi, 1–2, pp. 30–45, 3 pl., 1941.

The severe etch virus of tobacco [see preceding abstract] was found in the author's studies at the Rothamsted Experimental Station to induce in White Burley tobacco (*Nicotiana glutinosa* and *Hyoscyamus niger* also being used as experimental hosts) two types of intracellular inclusion, viz., cytoplasmic and intranuclear [*R.A.M.*, xix, p. 160], the former being amorphous, consisting of mixtures of proteins with fats and lipoids, and arising from the aggregation of particles which appear in the streaming cytoplasm. They may contain some birefringent particles and give rise to needle-like bodies, 2 to 5 $\mu$ in length. Unlike the intranuclear type of inclusion, the cytoplasmic can easily be pricked or divided into portions with a micro-needle. They contain the virus, which is also present, however, in other parts of the cell. The intranuclear inclusions give protein reactions and are more stable than those of the cytoplasmic type. They occur in the form of thin, rectangular, often square plates, with sides measuring up to 10 $\mu$ in length, the largest, however, being less than 0·5 $\mu$ in thickness; as many as 30 may be accommodated in a single nucleus. Both kinds of inclusion have been found in almost all the plant tissues, including the seed coat in the case of the intranuclear, but the young embryo is free from them. The severe etch virus was experimentally shown not to be transmissible by way of the seed.

The two types of intracellular inclusion are critically discussed in relation to the crystalline bodies observed in normal plants, e.g., dahlia and privet, and in both diseased and healthy plant and animal

tissues. Possibly their function may be that of a reserve substance, the view advanced by Tischler (Allgemeine Pflanzenkaryologie I, Berlin, 1934), while there is also some evidence that they arise from an unbalanced metabolism.

PRICE (W. C.) & BLACK (L. M.). **Unrelatedness of Tobacco-streak and Potato yellow-dwarf viruses.**—*Amer. J. Bot.*, xxviii, 7, pp. 594–595, 1 fig., 1941.

In cross-protection tests carried out in an attempt to clarify the relation between the tobacco streak and the potato yellow dwarf viruses [*R.A.M.*, xx, p. 180], artificially infected *Nicotiana rustica* plants showing the chronic stage of tobacco streak failed to develop further symptoms when inoculated with the tobacco streak virus, but when inoculated with the severe strain of potato yellow dwarf virus, or tobacco mosaic, tobacco necrosis, or tobacco ring spot viruses, they developed symptoms characteristic of the given virus. Of the plants affected by the chronic stage of potato yellow dwarf, those inoculated with the severe strain of potato yellow dwarf virus failed to develop further symptoms, while those inoculated with tobacco streak or any of the other three viruses previously used all developed local lesions typical of the virus used as inoculum. These results indicate that plants affected with tobacco streak are not protected against potato yellow dwarf virus, or vice versa, and it is concluded therefrom that the two viruses are not strains of the same virus, and in this sense are unrelated. Furthermore, the other viruses used do not seem to be related to each other.

HILL (A. V.). **Yellow dwarf of Tobacco in Australia. II. Transmission by the Jassid Thamnotettix argentata (Evans).**—*J. Coun. sci. industr. Res. Aust.*, xiv, 3, pp. 181–186, 1941.

Continuing his investigations into tobacco yellow dwarf in Australia [*R.A.M.*, xvii, p. 75; xix, p. 457], the author planted Dungowan and Dungowan Selection seedlings, 30 of each, in a field in Victoria under an insect-proof cover, an equal number being planted just outside the cage. All the covered plants remained healthy, though eight of the 60 controls became affected. Yellow dwarf scions were then top-grafted to 12 apparently healthy plants in the plant house, 12 other plants being topped to the height of the grafted ones. All the grafted plants became affected, while all the ungrafted ones remained healthy. Forty-six days after grafting, the cover was removed, and all the plants were cut off near ground level. The new shoots which developed from the bases of the 12 grafted plants developed yellow dwarf, while those on all the other plants formerly under cover were healthy. The controls were similarly cut off, and symptoms appeared in the new shoots of those visibly diseased when cut back and in two others as well. Next season the experiments were repeated elsewhere on Hickory Pryor seedlings, with similar results.

In insect transmission tests at Shepparton in 1939–40, insects of all species found in affected fields were put in cages (according to species) containing their hosts other than tobacco, and affected and healthy tobacco plants. The apparently healthy tobacco plants were removed

at intervals to an insect-free house, being replaced by other healthy tobacco plants. In all, 173 plants were placed in cages with various insects other than *Thamnotettix argentata* collected from a field where 95 per cent. of the plants later became affected, but none of these plants developed the disease, nor did it appear on any of the 150 plants kept in other, insect-free cages. In three cages in which *T. argentata* was placed, 15 of 53, 14 of 48, and 7 of 29 plants became affected. In another cage, in which all species collected at various times in a tobacco field were placed, 10 of 34 plants became affected. The minimum period for the development of symptoms on plants exposed to *T. argentata* in cages or in the field was 10 days, or about half the time required under greenhouse conditions for transmission by grafting.

Other transmission experiments with this insect were carried out at Canberra in 1940 and again at Shepparton in 1940–1. The disease was transmitted to 121 of 262 plants, whereas several hundred insect-free plants kept under similar conditions remained healthy. Both nymphs and adults of *T. argentata*, particularly those collected in November, transmitted the disease.

GADD (C. H.) & LOOS (C. A.). **A virus disease of Ageratum conyzoides and Tobacco.**—*Trop. Agriculturist*, xcvi, 5, pp. 255–264, 3 pl., 1941.

Some two years ago, the common weed *Ageratum conyzoides* growing on an estate in Ceylon developed a condition in which, seen from the upper surface, the veins of the top leaves appeared as yellow bands narrowing and growing less yellow towards the leaf base. On the under surface the veinbanding was less conspicuous, but the veins were yellow and stood out prominently owing to the interveinal areas being concave. On a few plants the leaf edges were curled downwards and inwards towards the lower surface, and some of these also presented thickenings of the smaller veins on the under surface, about 1 mm. long and arranged haphazard. When this vein-thickening appeared, it affected all the leaves that showed veinbanding.

The disease was experimentally transmitted from five affected to five healthy *A. conyzoides* plants by grafting diseased scions on to the main stems of the healthy plants, the chief resultant symptom being veinbanding.

In further tests, an affected *Ageratum* plant was placed in each of two insect cages, and white flies from tomato plants were introduced into the cages. Next day, three healthy Harrison's Special tobacco plants were put in one cage, and two in the other. After four days more, all the plants were sprayed with an insecticide. Disease symptoms developed on two tobacco plants in one cage and on one in the other. On the first two veinbanding was the dominant feature, but on the third this symptom was only transitory, and the leaves became crinkled and arched, the upper surface being convex, while the veins on the under surface were thickened and produced enations. This plant became stunted.

The authors conclude that the disease is probably caused by at least two viruses transferable to tobacco by white flies, of which one may cause veinbanding, and the other leaf curl with vein-thickenings or enations. The veinbanding symptom does not appear to be the same

as that described by Pal and Pandon as vein-clearing [*R.A.M.*, xvii, p. 74], or by Thung as transparency [ibid., xi, p. 478]. The figures of diseased *Ageratum* leaves published by Pruthi and Samuel [*Indian J. agric. Sci.*, ix, pp. 223–275, 1939] do not show the yellow lines along the veins. The virus responsible for the veinbanding is considered to belong to the tobacco leaf curl group, and is possibly more closely allied to the virus or strain causing transparent veins than to the one which produces vein-thickenings and enations. Apparently, also, the true leaf curl virus may cause the veinbanding symptom to be masked.

The complete eradication of the weed from the vicinity of tobacco is advised.

KRAMER (M.) & SILBERSCHMIDT (K.). **A 'faixa das nervuras', uma doença de virus do Fumo encontrada no Estado de São Paulo.** ['Veinbanding', a virus disease of Tobacco observed in the State of São Paulo.]—*Arq. Inst. biol., S. Paulo,* xi, 23, pp. 165–188, 3 pl., 1 graph, 1940. [English summary.]

Seven Virginia tobacco plants growing in an experimental plot at the São Paulo (Brazil) Biological Institute were observed, early in February, 1939, to show symptoms closely approximating to those of veinbanding [*R.A.M.*, xv, p. 738] and consisting of pale green, circular lesions, 2 to 5 mm. in diameter, situated between the secondary veins of the middle leaves, especially near the tip; this mottling persisted throughout the growing period and the newly developing foliage bore short, yellow lines, running partially parallel with the veins, while the veins of the middle leaves occasionally presented a generally chlorotic aspect and were traversed by dark, inconspicuous bands.

The disease was transmitted by means of juice inoculations from affected tobacco plants to the Havana, White Burley, Kentucky, Sumatra, and Yellow Rio Grande tobacco varieties, all of which produced more or less characteristic veinbanding symptoms; to *Nicotiana langsdorffii* (faint mottling), and *N. rustica* (mottling and short veinbanding). Similar experiments on *N. glutinosa* and *Datura stramonium* gave negative results, while those obtained with *Solanum nodiflorum* and *Petunia hybrida* were negative or doubtful. The President, Bintje, Eigenheimer, and Bevelander potato varieties contracted infection both through juice inoculations and grafting. President developed dark, necrotic rings and spots on the inoculated foliage, Eigenheimer showed small, circular spots, with pale grey, necrotic centres, on the middle leaves, Bintje contracted marginal chlorotic spotting of the middle leaves followed by mosaic of the new ones, while the initial mosaic of the young Bevelander foliage was succeeded by similar symptoms on the newly developing and middle leaves, accompanied by rugosity of the surface and small, grey, marginal lesions.

At a dilution of 1 in 500 the veinbanding virus was still capable of infecting White Burley tobacco plants but not those of the Havana variety, while negative results were obtained in both cases at 1 in 1,000. The thermal death point appears to be close to 60° C. (ten minutes' exposure), while the longevity of the virus *in vitro* exceeds 48 but does not reach 72 hours. These properties are critically compared with those of virus Y, as described by various American authors, and

of Köhler's potato virus P in Germany [ibid., xvi, p. 702], and considered to fall within the limits of the group constituted by aberrant strains of the former.

PORTE (W. S.) & WALKER (H. B.). **The Pan America Tomato, a new red variety highly resistant to Fusarium wilt.**—*Circ. U.S. Dep. Agric.* 611, 6 pp., 3 figs., 1941.

The Pan America tomato, developed by the Bureau of Plant Industry, United States Department of Agriculture, from a cross between Marglobe and a wild Peruvian Red Currant (*Lycopersicum pimpinellifolium*) selection, has remained almost free from wilt (*Fusarium bulbigenum* var. *lycopersici*) in field and greenhouse trials with virulent strains of the pathogen during the last ten years. The hybrid is reasonably productive, and appears suitable for canning and processing, as well as for marketing fresh. Seed of the new selection has been distributed to the trade and sufficient stocks should be available by 1942 to meet any probable requirements.

SELMAN (I. W.). **The effects of certain mosaic-inducing viruses on the Tomato crop under glass.**—*J. Pomol.*, xix, 1–2, pp. 107–136, 3 pl., 1 plan, 12 graphs, 1941.

A full account is given of experiments at the Cheshunt Research Station on the effect of tobacco virus 1 and of two strains (A15 and A17) of tomato mosaic virus (Bewley) on the growth, flowering, and fruiting of Potentate tomatoes under commercial glasshouse conditions. Cucumber virus 1 was also inoculated successfully into a few plants. The experimental design was a series of replicated plots. The plants were inoculated on 29th March and observations continued until mid-September when the fruit from five trusses had been harvested. On 15th May one control plant showed a virus mottling and by 20th June, when the fifth truss was in bloom, all the control plants showed similar symptoms, so that the experiment compared the results of early and late infection.

The principal results may be summarized as follows. Infection significantly reduced the weekly height increment of the main stem during the early part of the experiment before the controls became infected and induced a small, non-significant reduction in the weekly rate of leaf production during the same period. High partial coefficients were found to exist between the mean number of daylight hours during which the plants were exposed to a temperature of 70° F. or over and the percentage of plants showing a foliar mottle due to the tobacco or tomato mosaic viruses. There were significant reductions in the number of flower buds (trusses two to five) and the number of fruits picked on the early infected plants, on which the percentage of flower buds producing fruits was lowered in all cases. Relative to the controls the yield (from five trusses) was reduced by virus A15, A17, and tobacco virus 1 by 14·7, 22·3, and 20·1 per cent., respectively.

The time of appearance of the symptoms is considered to be a critical one in the metabolism of an infected plant.

Banfield (W. M.). **Distribution by the sap stream of spores of three fungi that induce vascular wilt diseases of Elm.**—*J. agric. Res.*, lxii, 11, pp. 637–681, 9 figs., 1941.

The author describes a series of experiments in which spore suspensions of *Ceratostomella ulmi* [*R.A.M.*, xx, p. 185], *Dothiorella ulmi* [loc. cit.], and *Verticillium dahliae* [cf. ibid., p. 39] were injected into elms (*Ulmus americana* and *U. fulva*). Later, the injected material was investigated by taking sap samples or by tracing discoloured vessels. The results were markedly affected by the season and the site of injection. During the early part of the leafy season, from injections made at stump-level spores of the fungi were found to have reached points near the tops of tall trees in a very short time (from 20 minutes to 48 hours in the case of *C. ulmi*, and 5 and 7 days in the case of *V. dahliae* and *D. ulmi*, respectively). Massive injections of *C. ulmi* 40 ft. above the stump resulted in spores reaching the stump in from 15 to 20 minutes. During the latter half of the leafy season transportation of spores was slower. *C. ulmi* spores were found in the sap of both naturally wilted and inoculated trees in 1936, both at bole and crown levels. During the non-leafy season the movement of spores was very slow, reaching not more than 24 in. above, or 12 ft. and 6 in. below injection sites in the stump, trunk, and terminal shoots, respectively.

Movement of spores from inoculations was still slower, amounting to only a few inches in a week; but after 4 months the spore distribution was very variable, ranging from a foot or two from the site of inoculation to the whole structure of the trees.

Suspensoids were observed to move very quickly through the large vessels, ascending to a maximum of 20 ft. in less than 10 minutes and descending to a maximum of 36 ft. in 6 minutes. It is concluded that the rapid invasion during the leafy season of the bole and crown of the American elm by the three wilt fungi is due to the distribution of their spores in the large vessels of the new annual ring by the sap stream.

Parker (K. G.), Readio (P. A.), Tyler (L. J.), & Collins (D. L.). **Transmission of the Dutch Elm disease pathogen by Scolytus multistriatus and the development of infection.**—*Phytopathology*, xxxi, 7, pp. 657–663, 1941.

In recent experiments at Cornell University, Ithaca, New York, *Ceratostomella ulmi* was obtained in a higher percentage (76·1) from the outer surfaces of adult *Scolytus multistriatus* beetles [*R.A.M.*, xx, p. 324] than from their intestinal tracts (14·3), the number of colonies in potato dextrose agar cultures also being much larger from the former than from the latter source. The pathogen was readily transmitted to healthy potted elm trees by the beetles in the course of their feeding activities and recovered in a viable condition from feeding scars on uninfected trees up to three years after inoculation; on the other hand, the fungus sometimes died in infected trees before systemic invasion was accomplished. Late spring and early summer inoculations were the most successful, little or no infection resulting from those made later in the season.

Brewer (E. G.). **The fight for the Elms. Review of progress made in the campaign against the Dutch Elm disease.**—*Amer. Forests*, xlvii, 1, pp. 22–25, 4 maps, 1941.

During the last 11 years, 60,975 elms attacked by the Dutch elm disease fungus [*Ceratostomella ulmi*] are stated to have been located, the maximum number for any one year (18,152) having been found in 1938, followed by 10,786 in 1939 and 3,931 up to 30th September, 1940 [*R.A.M.*, xx, p. 139]. The major region of infection has been extended from 2,464 sq. miles in 1934 to 10,000 sq. miles in 1940, while an additional number of isolated foci have been observed. However, an analysis of the results of scouting in 1940 shows that only one elm per 4,000 is diseased in New Jersey, the corresponding figures for Connecticut, New York, and Pennsylvania being one in 13,000, 16,000, and 19,000, respectively. In the course of sanitation work organized by the Department of Agriculture from 1933 to 1940, among other operations, 4,250,000 elms have been removed, material infested by beetle [*Scolytus*] has been excised from 250,000, and nearly 700,000 trees have been chemically destroyed. Since its inception the co-operative effort to eradicate the Dutch elm disease has been financed to the extent of $2,400,000 by the Department of Agriculture, $1,380,000 having been appropriated by the several States involved, and regular instalments totalling nearly $20,000,000 provided through the agency of emergency relief organizations.

Ito (S.) & Akatsuka (K.). **Twig blight of dwarf Elm tree.**—*J. Soc. Agric. For. Sapporo*, xxxii, 157, pp. 55–62, 2 pl., 1940. [Japanese, with English summary. Abs. in *Biol. Abstr.*, xv, 7, p. 1431, 1941.]

Some years ago twig blight of the dwarf elm (*Ulmus pumila*), a species introduced into the Sapporo district of Japan from Manchukuo in 1918, became so prevalent and severe as to kill the trees in patches and necessitate the renovation of the hedges for which they are chiefly used. The causal organism of the disease is apparently identical with *Thyrostroma compactum*, reported on *U. campestris* and *U. pumila* from Europe and the United States, respectively [and also from Canada: *R.A.M.*, xvii, p. 797]. Under local conditions the virulence of the pathogen is probably aggravated by the heavy pruning, insect injuries, and dense planting incidental to the mode of cultivation practised. Good control was obtained in three consecutive seasons by the excision of diseased twigs and sterilization of the cut surface with mercuric chloride solution.

Brown (Nellie A.). **Tumors on Elm and Maple trees.**—*Phytopathology*, xxxi, 6, pp. 541–548, 3 figs., 1941.

A species of *Phomopsis* with $\alpha$ and $\beta$ spores was isolated from dark, flat, nodular outgrowths, simulating those of crown gall (*Bacterium tumefaciens*), on American elms (*Ulmus americana*), and from the smooth, later rough, cankerous excrescences on maples (chiefly *Acer rubrum* and *A. saccharum*) in various parts of the United States [cf. *R.A.M.*, xvii, p. 779]. None of the diseased tissues yielded *Bact. tumefaciens*. The isolate from elm was inoculated with positive results

*nudiflorum*), and *Viburnum opulus*; growth was very slow, however, over five years being requisite, for instance, for the development of tumours 1½ in. in diameter on privet stems. In inoculation tests on elms with the peach strain of *Bact. tumefaciens* and the *Phomopsis*, 2 per cent. of 49 were successful with the former and 55 out of 106 with the latter. Moisture appears to be a necessary condition for the establishment of the *Phomopsis* in its hosts, and close planting, which helps to maintain a humid atmosphere, should be avoided where attacks are to be feared.

Marshall (R. P.). **Black spot fungus of Elm (Gnomonia ulmea (Schw.) Thuem.).**—*Tree Pest Leafl.* 41, 4 pp., 2 figs., 1940.

This is a semi-popular note on black spot (*Gnomonia ulmea*), stated to be the most prevalent leaf spot of the American elm (*Ulmus americana*) [*R.A.M.*, xix, pp. 338, 442], other species attacked being *U. fulva, U. alata, U. crassifolia, U. racemosa, U. pumila*, and *U. serotina*. The control of the disease in nurseries and on valuable shade trees should be based on the destruction of diseased material and spraying [ibid., xiii, p. 407]. Mention is made of two other fungi causing leaf diseases of elms, viz., *Gloeosporium inconspicuum* and *G. ulmicolum* [loc. cit.].

Diller (J. D.). **Asiatic Chestnuts as forest trees.**—*Amer. Forests*, xlvi, 1, pp. 19–21, 48, 3 figs., 1940.

This is an account of the position to date in the United States with regard to the campaign for the replacement of the native American chestnut (*Castanea dentata*), which is rapidly being decimated by blight (*Endothia parasitica*) [*R.A.M.*, xx, p. 140], by the resistant Japanese and Chinese species (*C. crenata* and *C. mollissima*, respectively). From 1927 to 1930 an expedition organized by the Bureau of Plant Industry explored the forests of Japan (including Korea and Formosa) for suitable material, and obtained about 250 bushels of seed from native strains. At the same time arrangements were made for subsequent consignments of nuts from Japan and China. The imported seed was planted in the Bureau's Maryland nursery, and from 1930 onwards seedlings have been distributed annually to Federal, State, and public agencies, the total number thus supplied for forest plantings from the New England States to Iowa and south to Florida and Texas being 275,000. The Asiatic chestnuts are somewhat exacting in respect of soil requirements, the 'yellow poplar' type of the central forest region of the eastern United States and the 'second bottoms', 'beech hills', or 'river terraces' of the Atlantic and Gulf coastal plain being well adapted to their growth and development. Protected sites facing north should be selected wherever possible.

Walter (J. M.). **Your shade trees. Watch your Sycamores.**—*Amer. Forests*, xlvi, 4, pp. 182–183, 188, 2 figs., 1940.

A popular account is given of the *Ceratostomella* disease of London planes (*Platanus acerifolia*) [*R.A.M.*, xix, pp. 501, 625], of which some 10,000 are stated to have succumbed in Philadelphia and neighbouring New Jersey cities directly across the Delaware River, and 1,000 at Baltimore, while from one to fifty infected trees are known to be

present in the Newark district of New Jersey and certain areas of Virginia, West Virginia, Delaware, Washington, D.C., North Carolina, and Mississippi. To date the cost of replacing dead by new trees in the affected regions is estimated at $400,000. The foliar symptoms of wilting, yellowing, and premature shedding do not appear until the characteristic elongated cankers on the trunks and branches and the reddish-brown to bluish-black discoloration of the underlying wood are well established. The latter feature is most pronounced in the medullary rays, where cross-sections frequently reveal wedge-shaped sectors. During the first year of invasion the cankers, though measuring 20 to 40 by under 2 in., are often indistinct and thus escape attention; they widen irregularly and coalesce, finally girdling the branch or trunk on which they occur, a period of three to five years being requisite for this process in the case of a stem 1 ft. in diameter. The dead bark darkens, dries, cracks, and sloughs off, and during rainy periods numerous spores are produced on the freshly exposed wood surface.

Infection may be spread by means of pruning saws. In July, 1939, pruning cuts were made with saws washed in alcohol and subsequently used on diseased wood, and by the following November 36 per cent. of the wounds had become infected, whereas similar cuts made with clean saws remained healthy. Infection may occur high up in the crown as well as on the trunk. Of 45 branch infections studied up to the present, 26 were associated with pruning cuts, 8 with injuries made by climbers' boots, 3 with accidental saw scratches, 2 each with rope burns and dead spurs, and one with a break due to wind, leaving only three with no definite history of a predisposing injury.

Field observations during 1939 indicated that the asphaltum wound dressings, as ordinarily applied, are not absolutely effective against the plane *Ceratostomella*, while the common practice of allowing contaminated sawdust to fall into the wound dressing cans is a frequent source of re-infection when the brush is dipped into the container prior to the treatment of fresh injuries.

WATERMAN (ALMA M.). **Sycamore and Oak Anthracnose. Gnomonia veneta (Sacc. & Speg.) Kleb.**—*Tree Pest Leafl.* 48, 4 pp., 5 figs., 1940.

The hosts of *Gnomonia veneta* [*R.A.M.*, xx, p. 183] in the United States are *Platanus occidentalis*, *P. acerifolia*, *P. orientalis*, *Quercus alba*, *Q. bicolor*, *Q. coccinea*, *Q. velutina*, *Q. borealis* [var.] *maxima*, *Q. rubra*, and (occasionally) *Q. palustris*, *Q. prinus*, and *Q. macrocarpa*. The summer leaf and twig stages of the fungus on *Platanus* are known as *Gloeosporium nervisequum* and *Discula platani* [ibid., xix, p. 444] or *Myxosporium valsoideum*, respectively, and similar stages occur on oaks. Control may be effected (where the value of the trees warrants the expense) by three applications of 4–4–50 Bordeaux mixture (1) in the early spring to prevent infection of the newly developing buds, and (2) and (3) at 10- to 14-day intervals to protect the leaves as they are formed. The excision and burning of diseased material and the sterilization of pruning implements are also advocated.

Toole (E. C.). **Fusarium wilt of the Mimosa tree (Albizzia julibrissin).**—*Phytopathology*, xxxi, 7, pp. 599–616, 1 fig., 2 graphs, 1941.

The following information, supplementing Hepting's observations, is presented concerning the vascular wilt of the mimosa tree (*Albizzia julibrissin*) in the United States, where centres of infection by *Fusarium perniciosum* have been detected in Virginia, South Carolina, and Georgia in addition to the previous report from North Carolina [*R.A.M.*, xix, p. 313].

The numerous isolates of the pathogen studied fell into three cultural groups based on their growth characters on various standard solid and liquid media, viz., (1) appressed with slimy mats and occasionally tufts of cottony, vinaceous-purple to white aerial mycelium (non-virulent in soil inoculation experiments), (2) raised mycelial, felty to cottony, purple (highly virulent), and (3) raised sclerotial, woolly, with occasional sporodochia (moderately virulent) [cf. ibid., xx, p. 92]. The results of water culture inoculations did not altogether agree with those of the soil inoculations, all three types producing more extensive wilting in the former than in the latter series, though the appressed group again gave the lowest percentage (60 compared with 75 and 82 for the raised sclerotial and raised mycelial, respectively). Saltation occurred in all three cultural classes.

Besides *A. julibrissin*, *A. lebbek* and *A. lophantha* were found to be susceptible to infection by *F. perniciosum*, the former being more, and the latter less, resistant than the original host to a highly pathogenic strain of the fungus.

*F. perniciosum* spreads on or through the soil, gaining ingress to the mimosa roots through the epidermis or root hairs, and traverses the cortex to the vascular system, the proper functioning of which is impeded, with the result that the foliage wilts and the plant dies. With the decay of the roots, the pathogen is once more released into the soil. The minimum, optimum, and maximum temperatures for the growth of *F. perniciosum* in culture are below 10°, about 25°, and just above 35° C., respectively.

Fisher (P. L.). **Germination reduction and radicle decay of conifers caused by certain fungi.**—*J. agric. Res.*, lxii, 2, pp. 87–95, 1941.

A number of organisms were isolated from surface-sterilized fresh and stratified coniferous seeds and seeds taken from nursery beds in which germination had failed, *Fusarium* spp. and various bacteria being the most frequent. Tested in inoculation experiments conducted at temperatures from 32° to 77° F., the following isolates caused radicle decay in *Pinus resinosa*, *P. ponderosa*, and *P. banksiana*: *Botrytis* (? *cinerea*), *Fusarium* spp., an unidentified Phycomycete, *Pythium de Baryanum*, *P. ultimum*, *Rhizoctonia* sp., *Verticillium* sp., *Sphaeropsis ellisii* [*Diplodia pinea*], and four unidentified fungi. *Aspergillus niger*, *Cylindrocladium* sp., *Penicillium* sp., *Pestalozzia* sp., plaster mould, and two unidentified fungi did not cause a consistent loss of radicles. *Alternaria brassicae* var. *microspora*, *Chaetomium globosum*, *Rhizopus circinans*, *R. oryzae*, *R.* sp., *Mucor* sp., *Thielavia* sp., and one unidentified fungus failed to attack the radicles, though

a general decrease in the percentage of germination occurred in practically all inoculated series, even when there was no visible radicle or seed decay. Temperature was found to exert a marked influence on the rate of germination: at 32° to 60° germination was delayed and spread out over about three months, while at 77° it was completed in approximately 30 days. There was no significant difference in the susceptibility of the hosts under the conditions of the experiment.

HEDGCOCK (G. G.). **Notes on Coleosporium jonesii (Pk.) Arthur.**—*Plant Dis. Reptr*, xxv, 8, pp. 244–249, 1941. [Mimeographed.]

*Coleosporium jonesii*, synonyms of which, according to Arthur [*R.A.M.*, xiii, p. 728], are *Uredo ribicola* C. & E. non Lasch, *U. jonesii* Pk, *C. ribicola* Arth. [ibid., ii, p. 348], and *Peridermium ribicola* Long, has long been known as a Rocky Mountain rust, but of late years its range has been extended to Minnesota, Washington, and Wisconsin. Its aecidial host, *Pinus edulis*, is most abundant in Colorado, where the fungus is epidemic on wild currants and gooseberries up to an altitude of 9,000 ft. above sea-level. *Ribes inebrians* and other native species, except *R. americanum*, which is rarely infected, are the chief alternate hosts of the rusts, cultivated gooseberries being rarely attacked and garden red currants apparently immune. *C. jonesii* differs from *Cronartium ribicola* and *C. occidentale* in its large caeomoid uredosori, while its teleutosori lack the hair-like structure of species of *Cronartium.* Four other rusts attacking *Ribes*, viz., *Melampsora ribesii-purpureae* Kleb., an undescribed *M.* sp., *Puccinia caricis-grossulariata* Arth., and *P. parkerae* Diet. & Holw., form no alternate stage on pine.

Inoculation experiments from 1917 to 1922 with aecidiospores of *Coleosporium jonesii* from *Pinus edulis* resulted in the infection of *R. aureum*, *R. grossularia*, *R. hirtellum*, *R. inebrians*, *R. inerme*, *R. innominatum* = *R. grossularia* × *divaricatum*, *R. missouriense*, *R. nigrum*, *R. odoratum*, and *R. sativum*. In tests with uredospores from *Ribes* from 1917 to 1924 positive infections were obtained on 16 species of *Ribes*. From 1916 to 1924 sporidia from teleutospores of *C. jonesii* from *Ribes* twigs were inoculated into 26 *Pinus* spp. with positive results on *P. edulis* and *P. pinea* only. In addition to the 23 species of *Ribes* found naturally infected in the United States *R. divaricatum*, *R. nigrum*, and seven other species were proved susceptible in inoculation experiments at Washington, D.C.

The uredospores of *C. jonesii* from 16 species of *Ribes* averaged 18 to 30 by 15 to 24 (mean 23 by 19·4) $\mu$, compared with 21 to 32 by 17 to 25 (26 by 20) $\mu$ for those of the most nearly allied species, *C. ipomoeae* [ibid., xix, p. 126].

FRIES (N.) & JONASSON (LISBETH). **Über die Interfertilität verschiedener Stämme von Polyporus abietinus (Dicks.) Fr.** [On the interfertility of various strains of *Polyporus abietinus* (Dicks.) Fr.]—*Svensk bot. Tidskr.*, xxxv, 2, pp. 177–193, 5 diags., 3 maps, 1941.

Fourteen fruit bodies of *Polyporus* [*Polystictus*] *abietinus* from spruce and pine wood in various localities of eastern and western Sweden were examined at the University of Upsala in April, 1941, from the standpoint of interfertility relationships. All the five fructifications subjected

to a complete analysis of sexuality were tetrapolar. All possible combinations of two monosporous mycelia from each of the 14 fruit bodies were made. Only nine combinations proved sterile, indicating that the fruit bodies of *P. abietinus* are not, as was expected, genotypically completely different as regards the genes controlling tetrapolarity but that some of these genes were common to several fructifications. The cells of the haploid mycelia are uni-, and those of the diploid mycelia binuclear. The diameter of the diploid hyphae exceeded that of the haploid by some 35 per cent., and the former also surpassed the latter in velocity of growth.

Boyce (J. S.). **Needle cast disease of Pines (Bifusella, Hypoderma, Hypodermella, Lophodermium).**—*Tree Pest Leafl.* 44, 4 pp., 1 fig., 1940.

A semi-popular account is given of the symptoms of needle cast of pines in New England and the life-history of its causal organisms, *Lophodermium pinastri* [*R.A.M.*, xviii, p. 360], *L. nitens*, *Hypodermella ampla*, *Hypoderma lethale*, *H. desmazierii* [ibid., xii, p. 667], and *Bifusella linearis*. Control by spraying is necessary and practicable only in nurseries.

Hansbrough (J. R.). **The Sweetfern blister rust of Pitch Pines (Cronartium comptoniae Arth.)**—*Tree Pest Leafl.* 45, 4 pp., 7 figs., 1940.

This is a semi-popular account of *Cronartium comptoniae*, the cause of heavy damage to a number of pines of the pitch or hard group in the United States [*R.A.M.*, xvii, p. 360], those sustaining the most severe injury in forest nurseries and young plantings being *Pinus ponderosa* and *P. contorta* in the Lake States and *P. sylvestris* and *P. taeda* in the north-east.

Ezekiel (W. N.) & Nelson (C.). **Sclerotial seedling blight of Black Walnut.**—*Plant Dis. Reptr*, xxv, 12, pp. 336–337, 1941. [Mimeographed.]

On 22nd May, 1941, black walnut (*Juglans nigra*) seedlings about 3 weeks old and 6 in. high in a nursery bed near Alto, Texas, were found to be dying, apparently as a result of infection by *Sclerotium rolfsii*. By 6th June, most of the plants were dead, 100 or so isolated seedlings scattered throughout a long bed having been killed. Not more than two or three affected plants were found in any one place; usually only a single plant, representing, apparently, an initial infection, had been attacked. Every diseased plant examined showed *S. rolfsii* strands and typical small sclerotia over the crown, and frequently over the large parent nuts still attached to the plants and situated 1 to 3 cm. below soil-level. The fungus appeared to be spreading from some of the seedlings in centrifugal white fans less than 1 cm. below the soil surface. Sclerotia were noted in these fans. Placed in a damp chamber, affected material developed yellowish-white to light buff to dull brown sclerotia, 0·8 to 1·1 mm. in diameter. This appears to be the first record of the fungus on *Juglans*. Infection was favoured by the artificial irrigation practised in the nursery and an exceptionally wet season.

FRIESE (W.). **Chemistry of true dry rot.**—*Pharm. Zentralh.*, lxxxii, pp. 217–224, 1941. [German. Abs. in *Chem. Abstr.*, xxxv, 17, p. 5928, 1941.]

The water content of the mycelium of the dry rot fungus, *Merulius lacrymans*, is stated to vary widely. The 'tears' contain an organic dyestuff and have an average $P_H$ of 3·32. The iron content of the fungus is very variable, whereas that of manganese is constant. The ash is very rich in potash and orthophosphoric acid. Silica was detected in mycelium growing over sandstone. Only minute amounts of tannin occurred in the fungus growing on oak. The spores of *M. lacrymans* yielded 15 per cent. of an oil with *n* 1·4741.

FISHER (R. C.). **Studies of the biology of the death-watch beetle, Xestobium rufovillosum de G. IV. The effect of type and extent of fungal decay in timber upon the rate of development of the insect.**—*Ann. appl. Biol.*, xxviii, 3, pp. 244–260, 2 graphs, 1941.

In continued studies at Princes Risborough [*R.A.M.*, xx, p. 140], the rate of development of the death-watch beetle, *Xestobium rufovillosum*, was studied in English oak sapwood (*Quercus robur*) decayed by *Phellinus cryptarum* (a white rot) and *Coniophora cerebella* [*C. puteana*] (a brown rot), and willow decayed by *Polystictus versicolor* (a white rot). The results showed that sound timber is unsuitable for infestation by first-stage larvae of the insect. The rate of boring and the development of the larvae increased with the increasing extent of decay in wood, in which they were living. By plotting the average minimum duration of the life-cycle of the insect against the extent of decay, it was evident that a decrease in the former is associated with an increase in the latter, both in the white and brown rot types. The effect of the fungus was most pronounced at the lower end of the decay scale, and little further effect was apparent when the extent of decay exceeded 45 per cent. in oak or 27 per cent. in willow.

AIROLA (E. V.). **Eräs märän paperimassan homevahinkojen vastustamiskeino.** [A method for the control of fungal damage to wet pulp.] —*Papp. Trävarutidskr. Finl.*, xxiii, 7a, pp. 112–114, 116–118, 120–122, 124, 126, 128–129, 10 figs., 2 graphs, 1941. [German summary.]

Following a brief survey of the methods hitherto practised against fungal damage to wet groundwood and chemical pulp, viz., treatment with chemicals, heat, and antagonistic micro-organisms [*R.A.M.*, xvi, p. 575], the writer describes a new Finnish mode of attack based on the reduction of air inside the bale by pressure to a degree which no longer suffices for the development of the agents of decay. The results obtained in experiments, in which sterilized mechanical and chemical pulp suspensions were inoculated with *Pullularia pullulans* [ibid., xviii, p. 774; xix, p. 634], showed that the pulp should be very thoroughly infected at the outset, so that the air remaining inside the bale is soon consumed and further development of the spores arrested. With slight initial infection, on the other hand, a comparatively large amount of air is available for each spore and growth proceeds without opposition. Under conditions of high initial infection (300,000 to 400,000

spores per gm.) a pressure of 10 kg. per sq. cm. was found to suffice for the control of the fungi in ground wood pulp, the corresponding figure for chemically prepared material being 15 kg. Much higher pressures are necessary for slight infection. The elimination of the mould was limited to the inside of the bales, the outside edges in contact with the air showing a profuse development. Similar results were obtained in tests with the causal organisms of red and brown rot [loc. cit.]. Frozen pulp being particularly susceptible to fungal damage, a series of tests was conducted with infected and pressed bales which were then allowed to freeze. No appreciable difference, as regards facility of control, was observed between the frozen and non-frozen pulp.

Lynch (P. B.). **Control of 'brown heart' of Turnips and Swedes.**—*N.Z.J. Agric.*, lxiii, 2, pp. 109–112, 2 figs., 2 graphs, 1941.

Further experiments in New Zealand during the past three years on the control of brown heart of swedes and turnips [*R.A.M.*, xix, p. 182] showed that no compound of boron tested, including 'rasorite' (a more concentrated form of borax), calcium borate, recrystallized borax (in large crystals), various pellets of bentonite and borax, and different mixtures of borax with fertilizers, applied at various rates at sowing, controlled the disease without adversely affecting germination. Increasing the seeding rate per acre when drilling with borax in contact with the seed gave more plants per acre, while lighter seedings sometimes resulted in higher percentage germination, though such increases were not large enough to compensate for the smaller number of seeds sown. Severity of germination injury was directly related to the amount of borax coming into contact with the seed. The most successful treatments were broadcasting and application in bands 1 to 1½ in. to the side of the seed in the drill; in the absence of suitable implements broadcasting is advised. Injury to germination was greatest in dry seasons, but heavy rain after an application appeared to leach the borax through the soil. Borax applications made even as late as the rough-leaf stage gave satisfactory results. The Vilmorin and Wilhelmsburger swede varieties appeared to be somewhat more resistant to brown heart than Superlative and Sensation.

In conclusion, it is recommended that 40 lb. of borax per acre should be broadcast before or soon after sowing. If heavy rain follows, the top-dressing should be repeated. Heavy rather than light rates of seeding should be used, and where infection is severe, Wilhelmsburger and Vilmorin swedes may be planted.

Kalchschmid (W.). **Krankheiten an Kohlgewächsen und ihre Bekämpfung.** [*Brassica* diseases and their control.]—*Dtsch. landw. Pr.*, lxviii, 21, pp. 185–186, 4 figs., 1941.

The only fungal disease discussed in this article on the disorders of *Brassica* crops in the Bayreuth district of Germany is club root (*Plasmodiophora brassicae*), for the control of which the following measures are recommended: (*a*) in the seed-bed; quadrennial to quinquennial crop rotation, or if this is impracticable, soil sterilization with unoiled calcium cyanamide, superphosphate, and 40 per cent. potash

[*R.A.M.*, vii, p. 691] at the rates of 100, 50, 50 gm. per sq. m., respectively, 14 days before planting, or for small areas brassisan [ibid., xx, p. 146] (50 gm. per sq. m., mixed with dry sand and incorporated at a depth of 5 to 10 cm.): (*b*) in the field; immersion of the seedlings before transplanting in a mixture of 2·5 gm. uspulun, 25 gm. solbar, and 1 l. water, converted into an emulsion by the admixture of loam; substitution of mineral fertilizers for organic manure in plots suspected of harbouring the pathogen; crop rotation or soil sterilization as described above; and thorough sanitation.

WENZL (H.). **Mykologische und ökologische Studien über die Blattbräune der Rübe. Gibt es ein Sporodesmium putrefaciens als Erreger der Blattbräune?** [Mycological and ecological studies on Beet leaf browning. Is there a *Sporodesmium putrefaciens* as the agent of leaf browning?]—*Zbl. Bakt.*, Abt. 2, ciii, 18–20, pp. 335–347, 2 figs., 1 graph, 1941.

Previous investigations by Pierrette C. Bolle [*R.A.M.*, iv, p. 60] and A. Wenzel [ibid., xi, p. 147] have already shown that the familiar and widespread leaf browning of beets is not a virulent disease, the fungi on the affected foliage being merely facultative pathogens.

An exceptionally severe outbreak of the trouble in 15 beet-growing districts of the Danube Valley (mostly the lower reaches) in July and August, 1939, afforded an abundance of material for examination, which was carried out *in situ*, in the moist chamber, and in onion decoction-saccharose-peptone agar cultures. The predominating fungus in all the specimens was identified as *Alternaria tenuis* [ibid., xix, p. 319], the conidia of which measured 22 to 88 by 9 to 22 (mean 41 by 12·5) $\mu$ and 13 to 72 by 7 to 20 (28 by 12) $\mu$ in the moist chamber and in culture, respectively, while those developing in nature were mostly 50 to 80, occasionally up to 120 $\mu$ in length and 15 to 17 $\mu$ in width. The presence of *A. cheiranthi* (Fr.) Bolle [ibid., xvi, p. 482] in the diseased material could not be established with certainty, and the writer is of opinion that it is not concerned in the pathogenesis of leaf browning. Frequent concomitants of *A. tenuis* were *Cladosporium herbarum* and *Macrosporium* (probably *M. sarcinula* [*Stemphylium botryosum*]). *Sporodesmium putrefaciens* [ibid., xv, p. 549] does not enter into the picture at all, and its reputed association with the leaf browning is attributable to confusion on the part of Frank (1896), who interpreted the *Alternaria* and *Cladosporium* conidia as stages in the life-history of a single fungus, *S. putrefaciens*.

Differences in the incidence of leaf browning in an alluvial soil at Ober-Siebenbrunn, east of Vienna, at intervals of a few metres were found to be due to the texture of the subsoil, diseased plants being observed in four places where broken stones occurred at levels of 30, 35, 55, and 65 cm., whereas in four other sites supporting healthy beets the chippings were only found at depths of 100, 120, 125, and below 130 cm., respectively. These observations point to drought as a predisposing factor in the development of the disorder, for the control of which no measures have yet been devised, since the underlying climatic and edaphic factors are scarcely susceptible of modification.

Sanford (G. B.). **Pathogenicity tests on Sugar Beets of random isolates of Rhizoctonia solani Kühn from Potato.**—*Sci. Agric.*, xxi, 12, pp. 746–749, 1 fig., 1941.

In three years' pathogenicity trials in Alberta, in which 148 isolates of *Rhizoctonia* [*Corticium*] *solani* obtained from sclerotia on potato tubers, from lesions on potato stems, and from basidiospores of the *Corticium* stage on potato stems [cf. *R.A.M.*, xvii, p. 481; xx, p. 175] were tested on large sugar beets in the field (by placing inoculum approximately 3½ in. below ground-level, next to each of 10 large, unwounded roots), none of the isolates showed any ability to infect the beets. All the sugar beet controls similarly inoculated, however, with three isolates obtained from, and virulent to, that host, were killed each year within 20 days at average soil temperature of 12° and 15° C. [cf. ibid., xix, p. 59]. It is evident, therefore, that the sugar beet pathogen would be capable of causing severe damage to that crop in Alberta, but whether strains pathogenic only to sugar beet might be harboured or increased by a potato crop remains unknown.

Coons (G. H.), Stewart (D. E.), & Gaskill (J. O.). **A new leaf-spot resistant Beet variety.**—*Sugar*, xxxvi, 7, pp. 30–33, 2 figs., 1941.

A tabulated account is given of the experimental work at the Division of Sugar Plant Investigations, Bureau of Plant Industry, United States Department of Agriculture, which has culminated in the release of a new sugar beet variety, U.S. 215×216, resistant to leaf spot (*Cercospora*) [*beticola*] and superior to the earlier introduction, U.S. 200×215 [*R.A.M.*, xx, p. 286], now widely grown in eastern districts and to some extent also in the irrigated lands east of the Rocky Mountains. U.S. 216, which replaces 200 in the new hybrid, excels in root yield, sucrose percentage, and leaf spot resistance, while U.S. 215 also withstands the disease better than European varieties, and both are equal to the latter in their acre yields of sugar.

Stoker (G. L.) & Tolman (B.). **Boron deficiency relations in Sugar Beets grown for seed in Oregon.**—*J. Amer. Soc. Agron.*, xxxiii, 7, pp. 657–665, 4 figs., 1941.

Boron deficiency of sugar beets [*R.A.M.*, xx, p. 518] grown for seed in western Oregon is initially expressed by dwarfing of the seed-stalk and an abnormally dark green coloration of the foliage and developing inflorescence, and is characterized in subsequent phases by distortion and darkening of the upper part of the central seed-stalk and the discoloration and death of some or all of the lateral floral shoots, and often by partial recovery, with a witches' broom type of inflorescence of the multiple second-growth shoots. The disease was found to be controllable by the application of borax at the rate of 30 lb. per acre. Henceforth this treatment (25 to 35 lb. per acre) will constitute a regular part of the fertilizer schedule to be followed in the affected areas.

Davey (A. E.) & Leach (L. D.). **Experiments with fungicides for use against Sclerotium rolfsii on soils.**—*Hilgardia*, xiii, 10, pp. 523–547, 1941.

*Sclerotium rolfsii*, the agent of southern sclerotial rot of sugar beets

in the Sacramento Valley of California [*R.A.M.*, xx, p. 508], has been found to grow on media with a wide range of hydrogen-ion concentrations ($P_H$ 2 to 8) [ibid., vii, p. 48], while in the field the incidence of the disease does not vary appreciably with the soil reaction up to $P_H$ 8. Moderate applications of lime to the soil have caused only a slight reduction of infection. None of the 17 water-soluble chemicals and fungicides tested in the laboratory, and for the most part in the field also, proved more effective than formaldehyde under all conditions, though several, including ammonia [ibid., xv, p. 194], were more potent *in vitro*. In field tests, with one exception, formalin (37 per cent. formaldehyde, diluted 1 : 100 and applied at the rate of 3 gals. per sq. ft. of soil surface), destroyed the sclerotia to a depth of 6 in., whereas ammonia (28 per cent. $NH_3$) and sodium hydroxide at the same concentrations and rates failed to cause any considerable diminution in the amount of inoculum. The timely removal of diseased beets from infested fields, combined with chemical treatment of the surrounding soil, reduced the incidence of *S. rolfsii* in the same row only. Of the five volatile, non-water-soluble fungicides tested, xylene, tetrachlorethane, and pentachlorethane failed to kill the sclerotia even at the maximum doses of 5,000 parts per million of soil under humid conditions, whereas chloropicrin and carbon disulphide were toxic at rates as low as 100 and 600 p.p.m. of soil, respectively. When properly confined (a matter of some difficulty), 2 c.c. chloropicrin per sq. ft., injected at a depth of 6 in., sufficed to kill the sclerotia to a depth of 1 ft. in the experimental plots of Columbia silty clay loam. Some 97 per cent. of the sclerotia in the surface zones of piles of screenings at beet receiving stations succumbed to the effect of the fumigant. Such screenings are now piled on non-agricultural land presenting no menace to cropped land and not returned to each grower's truck as was formerly done, the necessity for using fungicides being thereby avoided.

DUNDAS (B.). **Further studies on the resistance to powdery mildew of Beans.**—*Hilgardia*, xiii, 10, pp. 551–565, 1941.

In further studies at the California Agricultural Experiment Station on the reaction to powdery mildew (*Erysiphe polygoni*), the strain used now being designated strain 1, of the $F_1$, $F_2$, and $F_3$ generations of crosses between resistant and susceptible bean varieties [*R.A.M.*, xx, p. 43], the tests were made on detached leaves supported on cotton in a 10 per cent. sucrose solution in Petri dishes as before described [ibid., xvi, p. 363] and in addition for certain $F_3$ generations field inoculation was used. The varieties Striped Hopi, Lady Washington, Hungarian, Yellow, Long Kidney, *Phaseolus vulgaris* 5053, and Pinto were found to be resistant at all stages of growth, while Pink was susceptible in the initial phase but acquired resistance with advancing maturity. Robust, Small White, Kotenashi, and Red Kidney were susceptible, while Long Roman was semi-resistant in the field but susceptible in dish tests.

The $F_1$ and $F_2$ of Robust × Striped Hopi and its reciprocal cross were tested by the dish method, and the $F_3$ of the former by field inoculation also. The $F_2$ segregated in a ratio of three resistant to one susceptible,

showing resistance to mildew to be due to a single dominant Mendelian factor pair. Similar results were obtained in crosses of Lady Washington × Small White, Long Roman × Lady Washington, Robust × Hungarian, Long Roman × Hungarian and its reciprocal cross, Yellow × Long Roman, Robust × Yellow, *P. vulgaris* 5053 × Red Kidney, Long Kidney × Red Kidney, Robust × Pink, and Pink × Kotenashi.

In crosses between resistant varieties, the $F_1$, $F_2$, and $F_3$ generations from Lady Washington × Pinto, Hungarian × Pinto, Yellow × Pinto, *P. vulgaris* 5053 × Pinto, Pinto × Striped Hopi, Long Kidney × Pinto, Pinto × Pink, and the $F_1$ and $F_2$ from Yellow × Hungarian and Yellow × *P. vulgaris* 5053 were all resistant, denoting that these varieties carry the same single Mendelian factor for resistance to mildew.

Jenkins (W. A.). **A histological study of Snap Bean tissues affected with black root.**—*J. agric. Res.*, lxii, 11, pp. 683–690, 4 pl., 1941.

In a histological study of snap beans (*Phaseolus vulgaris*) affected with black root, a virus disease reported from Georgia in a previous paper by the same author [*R.A.M.*, xix, p. 515], fresh and fixed material of several bean varieties and progenies from segregating hybrids was examined by staining with various dyes of which Pianese III b, alcoholic safranin counter-stained with light green in clove oil, and Heidenhain's iron-alum haematoxylin proved the most suitable. It was found that the external symptoms exhibited by the roots, hypocotyls, stems, and pods of diseased plants are correlated with a necrosis of the phloem, cambium, and outermost layer of xylem of these parts. The necrotic symptoms in the phloem cells ranged from slight cytoplasmic disorganization to more or less complete destruction of the cytoplasm and nucleus, the cell contents finally resembling gum and the cellulose walls becoming covered by deposits of suberin. Furthermore, sieve-tubes showing early symptoms were found plugged by callose pads. In the cambium, areas adjacent to the phloem showed the same condition as that prevailing in the phloem, while areas nearest to xylem were affected similarly to the xylem, in which few symptoms developed except in the ray parenchyma and the xylem parenchyma around the youngest scalariform vessels nearest the cambium; severe necrosis was occasionally found in these layers of the xylem. In the vessels of the xylem only very exceptional cases of plugging were observed and very few tyloses were seen.

It is tentatively suggested that the sudden wilting of bean plants affected with black root may be largely due to the destruction of xylem parenchyma which is of vital importance for plant nutrition, further damaging factors being possibly the plugging of the scalariform perforations by gum, particularly in the hypocotyl, and the physiological effects of phloem and cambium necrosis. The necrotic symptoms of the phloem were traced into the seed coat near the chalaza. No evidence of infection was observed in the embryo, but only very young embryos were examined. It is believed that black root is at least to some extent transmitted by seed, and it is suggested that the transmission may occur by transfusion of the virus from the seed coat to the embryo or take place when the embryo ruptures the vascular system of the seed coat during germination.

TOOLE (E. H.), WESTER (R. E.), & TOOLE (V. K.). **The effect of fruit rot of Eggplant on seed germination.**—*Proc. Amer. Soc. hort. Sci.*, xxxviii, pp. 496–498, 1 fig., 1941.

In a test made in Maryland to determine the effect of eggplant fruit rot (*Phomopsis vexans*) on seed germination, fruits of the Black Beauty and Fort Myers Market varieties were collected and divided into four groups, showing, respectively, (1) no infection, (2) slight, (3) medium, and (4) severe infection, with 80 to 100 per cent. of the fruit surface covered with lesions, the heavy seeds from each fruit being germinated on blotting paper. The results [which are tabulated] showed that the seeds from the healthy fruits germinated much more rapidly and had a much higher final percentage of germination than the seeds from the infected fruits.

LAMBERT (E. B.). **Mushroom growing in the United States.**—*Fmrs' Bull. U.S. Dep. Agric.* 1875, 38 pp., 15 figs., 1 diag., 1 graph, 1 map, 1941.

This bulletin, superseding No. 1587 in the same series and *U.S. Dep. Agric. Circ.* 251 [*R.A.M.*, xii, p. 352], contains, in addition to a section on mushroom (*Agaricus* [*Psalliota*] *campestris*) diseases (pp. 28–30), much valuable information, designed to meet the requirements of inexperienced growers, concerning the methods to be employed for the successful production of the crop, the commercial importance of which in the United States has greatly increased of recent years. At present the total annual output, mainly of the white type variously known in the trade as Snow White, White King, and White Queen, amounts to some 35,000,000 lb., grown for the most part in specially constructed houses. Small refrigeration plants, generally based on the washed-air principle and utilizing water pumped from deep wells, enable the period of cultivation to be extended to comprise the late spring and early autumn, while all-the-year-round growth is practicable with the aid of mechanical refrigeration. In the recently introduced 'two-zone' or 'tray' system the prepared compost is placed in movable trays which can be transported into caves or disused warehouses for the growing season.

Details are given of the experimental use of synthetic compost [ibid., xviii, p. 9] prepared by adding suitable mineral nutrients to soaked straw. The most satisfactory compost is stated to be that obtained by wetting 1,000 lb. of straw with two to three times its weight of water, either by sprinkling the straw as turned or by soaking bales of straw in vats, and then adding urea, dried blood, ground limestone, superphosphate, screened soil, and horse manure at the rates of 10, 40, 20, 40, 500, and 100 lb., respectively, and composting in the usual way. The compost so prepared is equivalent to 2 to 3 tons of horse manure and under favourable conditions a yield of $1\frac{1}{2}$ lb. per sq. ft. has been obtained. Over a period of years the synthetic compost has yielded only two-thirds as well as horse manure, but fairly normal yields can be expected when the mixture contains as much as one half horse manure.

During the past ten years the commercial yield of mushrooms has increased from 1 lb. per sq. ft. of bed space to about $1\frac{1}{2}$ lb., some of the factors at least partially responsible for this increase being a realization of the harmful effects of overheating during composting,

the use of fans for air circulation during this process, control of bubbles disease (*Mycogone perniciosa*) through the selection and treatment of the casing soil, regulation of the hydrogen-ion concentration of the casing soil, recognition of the conditions favouring the truffles disease (*Pseudobalsamia microspora*), improvements in fumigation and insect control, and improvement of spawn strains.

PADWICK (G. W.). **Mushroom cultivation in India.**—*Indian Fmg*, ii, 7, pp. 363–366, 1 pl., 1941.

Edible fungi popular among the natives in different parts of India include *Morchella esculenta* (Kashmir and Punjab), *Volvaria terastria, Lepiota albuminosa, L. mastoides, Psalliota campestris* (Bengal), and *Podaxon pistillans* (certain districts of the plains), while *V. diplasia* is widely grown for food in Burma [*R.A.M.*, xx, p. 100]. Among the species adapted to large-scale cultivation in India may be mentioned *V. diplasia, Panaeolus cyanescens*, and *Coprinus niveus*, while many inquiries have been received concerning the industrial possibilities of *Psalliota campestris*, which are here discussed [cf. preceding abstract] under the headings of varieties and preparation of spawn, bed preparation, cultivation requirements and procedure, importance of temperature, and insect control.

RIVES (L.) & NYSTERAKIS (F.). **The cause of resistance to mildew of American Vines and their hybrids. I. Influence of the concentration of cellular fluid. Refractometric measurements. II. Influence of acidity. $P_H$ measurements.**—*Progr. agric. vitic.*, cxxiii, pp. 168–170, 209–211, 1941. [French. Abs. in *Chem. Abstr.*, xxxv, 12, p. 4147; 16, p. 5621, 1941.]

No direct relationship could be established between either the concentration of the cellular fluid or its acidity and specific resistance to [downy] mildew [*Plasmopara viticola*] in American vines and their hybrids [*R.A.M.*, xiii, p. 148]. Acidity being excluded as a determining factor in this connexion, the use of basic spray mixtures should not interfere with the immunity of the vines under observation.

ARTIGAS (C. M.). **Tratamientos contra el mildiu a base de reducir las cantidades ordinarias de sulfato de cobre.** [Anti-mildew treatments on the basis of a reduction in the normal quantities of copper sulphate.]—*Agricultura, Madr.*, x, 109, pp. 162–166, 1 fig., 2 diags., 1941.

Since 1912, experiments have been conducted at the Villafranca del Panadés (Spain) Viticultural Station to determine the possibilities of combining effective control of vine downy mildew (*Peronospora*) [*Plasmopara viticola*] with economy in the use of copper sulphate, which at the present juncture is definitely dictated by the military situation. Among the formulae tested with satisfactory results was that of Menozzi, used in Italy prior to 1915 and consisting of 500 gm. each of copper and iron sulphate, 100 l. water, and sufficient lime to induce a slightly neutral reaction, the cost of which amounted to only 34·07 pesetas for 12 treatments as against 182·60, 179·66, and 108·87 pesetas for Bordeaux mixture, copper acetate, and the 'verdillo' copper compound, respectively. Unless excessively humid conditions supervene, Spanish viticulturists are recommended to give the Italian formula a trial during the present crisis.

JENKINS (W. A.). **Diseases of the Muscadine Grape.** *Ex* **Further studies with the Muscadine Grape.**—*Bull. Ga Exp. Sta.* 217, pp. 19–29, 5 figs., 1941.

The species of *Guignardia* responsible for black rot of muscadine grapes in Georgia is stated to differ in several important respects from *G. bidwellii*, the agent of a disease of the same name on bunch varieties, which is more or less confined to the berries, whereas the muscadine pathogen attacks all the aerial portions of the vine, causing destructive cankers on the current-year canes, the flower clusters, the fruiting pedicels, and the berries, especially of such superior varieties as Hunt, Yuga, and Creek. The cane cankers harbour the fungus during the winter and thus serve as important sources of spring infection. The diseased berries may remain hanging on the vines in a shrivelled, mummified condition, while in other cases they are promptly shed, a condition known as 'shelling'. In seasons when pedicel cankers are numerous, the ground below the affected vines has been strewn with fallen berries, representing a 10 to 50 per cent. loss of marketable fruit. The small, scab-like lesions developing on some older varieties, e.g., Scuppernong, do not materially impair the quality of the fruit. The perfect stage of the organism is produced in the fallen foliage, the ascospores proceeding from which attack the newly formed leaves in the spring. Conidia also develop on old, dying or dead portions of the vines and berries, infected one-year-old canes, and fruiting pedicels.

*Mycosphaerella angulata* n.sp. (a description of which is expected to appear in a forthcoming number of *Phytopathology*) produces on the leaves chlorotic, later brown to black spots surrounded by haloes and tending to assume an angular shape due to their delimitation by the veins and veinlets. Under humid conditions a grey mycelial efflorescence spreads over the leaf surfaces, the upper being chiefly involved, while in relatively dry weather the under sides bear pustule-like masses of grey, fasciculate conidiophores, on which are produced numerous conidia capable of spreading from leaf to leaf and so contributing to the severity of the disease. Bunch grapes are not susceptible to infection by *M. angulata*, which is also less virulent to the older types of muscadine, Scuppernong, Flowers, and Thomas. Like the *Guignardia* responsible for muscadine black rot, *M. angulata* persists through the winter on fallen leaves and initiates new foliar infections in the spring by means of its ascospores.

An apparently new *Macrophoma* closely related to *M. acniorum* Pass. causes a soft rot of the berries, which in most varieties drop before decay is complete and become mummified on the ground. The fungus has been isolated from overwintered, diseased berries, from old, infected pedicels, and from dying and dead one-year-old canes, and is strongly suspected to be the imperfect stage of a *Physalospora* nearly allied to *P. baccae* [*R.A.M.*, xv, p. 75]. The small, black fruiting bodies are densely strewn over the rotten berries.

At a very early stage of the bitter rot caused by a species of *Melanconium* the berries display extensive areas of fairly large, pulverulent, olive to black pustules, and rapid shrivelling ensues, the old berries being almost entirely filled with stromatic mycelium and thus genuinely mummified, unlike those infected by the *Macrophoma*, in which

dehydration and collapse are followed by gradual desiccation. The *Melanconium* has been isolated from overwintered mummified berries and diseased pedicels, as well as from the bark of dying or dead one-year-old canes. The soft and bitter rot pathogens are believed frequently to gain ingress to the berries through mechanical or insect injuries, and they are known to enter by way of the black rot injury and complete the work of destruction thus initiated.

All the above-mentioned diseases are amenable to control by three applications of 4–5–50 Bordeaux mixture [cf. ibid., xx, p. 338], the first to be given as the young leaves emerge from the buds and do not exceed $\frac{1}{2}$ to $\frac{3}{4}$ in. in size, the second eight to ten days later, preceding rain, and the third after another similar interval. These treatments should be preceded by a dormant spray in early February of 4 lb. copper sulphate per 50 gals. water, and accompanied by stringent vineyard sanitation.

**Statutory rules and orders, 1941, No. 1439. Destructive Insect and Pest Acts, England. The Wart Disease of Potatoes Order of 1941. Dated September 12, 1941.**—6 pp., 1941.

The Wart Disease of Potatoes Order of 1941, effective as from 15th September, 1941, and applicable to England and Wales only, revises the existing regulations in respect of *Synchytrium endobioticum* [*R.A.M.*, xii, p. 800] as follows. The operation of previous Orders, coupled with the successful results of plant-breeding work during the last 20 years, has greatly reduced the spread of the disease and lessened its economic importance; moreover, some two-thirds of the varieties now in commercial production are immune from infection. Under the new Order, all outbreaks of wart disease must continue to be notified as heretofore, and the planting of non-immune varieties on land that has at any time been infested remains an offence, but it is no longer deemed necessary to schedule large regions of the country as 'infected areas' or to require 'clean land' certificates in respect of all seed potatoes, these being necessary only in the case of stocks planted or sold for planting, in the protected areas surrounding the Wash and comprising certain districts in the administrative counties of Lincoln, the Soke of Peterborough, the Isle of Ely, and Norfolk; in other parts of England, all potatoes planted or sold for planting must either be officially certified as having been inspected while growing and found to satisfy the prescribed standards of purity and health, or carry a licence issued by the Minister of Agriculture. (An explanatory leaflet states that as an emergency war-time measure, a general licence has been issued authorizing the planting and sale for planting, except in the protected areas, of all ware and seed potatoes grown in the British Isles. The Order does not preclude the planting on any land of seed saved from the crop grown thereon in the previous year, unless the latter was infected by *S. endobioticum*, but growers are advised to give preference to seed potatoes officially certified or known to come from satisfactory stocks.)

**Service and regulatory announcements January–March, 1941.**—*S.R.A., B.E.P.Q., U.S. Dep. Agric.*, pp. 29–39, 1941.

Particulars are given of the plant quarantine import restrictions in force in the Republic of Brazil, British India, French Zone of Morocco, and the Free City of Danzig.

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